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HENRY S. GRAVES, Forester

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GROUND-WOOD PULP.

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CONTENTS.

OBJECT OF THE BULLETIN.

This bulletin presents the results of tests on (*a*) the grinding of steamed or cooked spruce for mechanical pulp and (*b*) the results of tests on a number of American woods to determine their suitability as substitutes for spruce in the manufacture of ground-wood pulp.[1] If the price of news-print paper is to be kept at a reasonable figure, more efficient methods of converting spruce into pulp must be developed or else a cheaper wood substituted for the former. The results of experiments meant to develop greater efficiency in the grinding of uncooked spruce have already been presented in Forest Service Bulletin 127, "The Grinding of Spruce for Mechanical Pulp." That bulletin also discusses the influence of the many

[1] Acknowledgment is made to Mr. C. P. Winslow, Mr. Henry E. Surface, and Mr. S. D. Wells, engineers in forest products, and to Mr. S. E. Lunak, assistant chemist in forest products, Forest Service, for aid in the preparation of this report. Acknowledgment is also due Messrs. G. F. Steele, W. G. McNaughton, and L. M. Alexander, of the Nekoosa-Edwards Paper Co., and Mr. D. C. Everest, of the Marathon Paper Mills Co., for assistance rendered during the tests; also to Mr. C. W. Knapp, of the St. Louis Republic, and to Messrs. P. W. Schaeffer and E. D. De Witt, of the New York Herald, for providing the presses upon which the experimental papers were tried out. The maps in this bulletin showing the range of the various tree species were prepared in the Forest Service by Mr. William H. Lamb, assisted by Miss Georgia Wharton.

Note.—This bulletin contains valuable information as to the use of various species of wood in the manufacture of paper and is of interest to manufacturers and users of paper.

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variable conditions in the manufacture of mechanical pulp, such as surface of stone, pressure with which the wood is forced upon it, peripheral speed, temperature of grinding, etc. Since the conclusions reached in regard to these are applicable to the production of pulp from coniferous woods in general, it is advisable to have a copy of Bulletin 127 at hand when reading the present one.[1]

All the tests described in this bulletin were carried on at the Forest Service ground-wood laboratory at Wausau, Wis., a branch of the Forest Products Laboratory, Madison, Wis., in cooperation with the American Paper and Pulp Association, which furnished all the pulp-making equipment for the laboratory, and with an advisory committee consisting of Messrs. G. F. Steele, chairman, and W. G. McNaughton, secretary, Nekoosa-Edwards Paper Co.; D. C. Everest, Marathon Paper Mills Co.; W. L. Edmonds, Wausau Paper Mills Co.; A. M. Pride, Tomahawk Paper Co.; and William Eibel, Rhinelander Paper Co.

PRESENT STATUS OF THE GROUND-WOOD INDUSTRY.

Thirty-five to forty-five years ago news paper was made almost entirely of rags. Upon the introduction of the sulphite process of wood-pulp manufacture varying amounts of that product were added to the rag pulp, and later ground wood was made a part of the mixture, but only in small quantities. Ground wood was for many years nothing more nor less than a filler and not expected to add any strength to the sheet produced. There is shown in figure 1 the average contract price (f. o. b. mill) of news-print paper from 1874 to 1912. The effect of the introduction of the cheaper processes is evident.

In 1870 there were only 8 establishments reported which made ground wood, and the product manufactured during that year was valued at $172,000. Ten years later, in 1880, 50 establishments produced $2,257,000 worth of ground wood. In 1890, 82 establishments reported products valued at $4,628,000. In 1900 there were 91 plants reported, which produced 280,520 tons of ground wood for sale, and 77 mills which produced 306,520 tons of pulp for their own use, a total of 168 mills, producing 586,000 tons, valued at approximately $9,300,000. In 1909 there were produced a total of 1,179,266 tons of mechanical pulp. Of this amount 310,747 tons were manufactured for sale or consumption in mills other than where produced, the value being $5,649,466. The remainder, 868,519 tons, assumed to have the same value of that made for sale, was worth approximately $15,780,000, or a total value of product of $21,430,000.

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[1] Copies of Forest Service Bulletin 127 may be procured from the Superintendent of Documents, Washington, D. C., for 15 cents each.

In 1911, 1,229,719 tons of mechanical pulp were produced, an increase of approximately 50,000 tons.

While the industry has developed very rapidly in the United States, the rate of development has not kept pace with the rate of consumption of the product. This is evident from a consideration of the imports and exports of both mechanical and chemical pulp over a period of years, as shown in figures 2 and 3. Figure 2 shows the imports of mechanical pulp, both free and dutiable, by months for a period of years, while figure 3 (curve *B*) shows the imports of mechanical pulp by years. The first of these curves is particularly

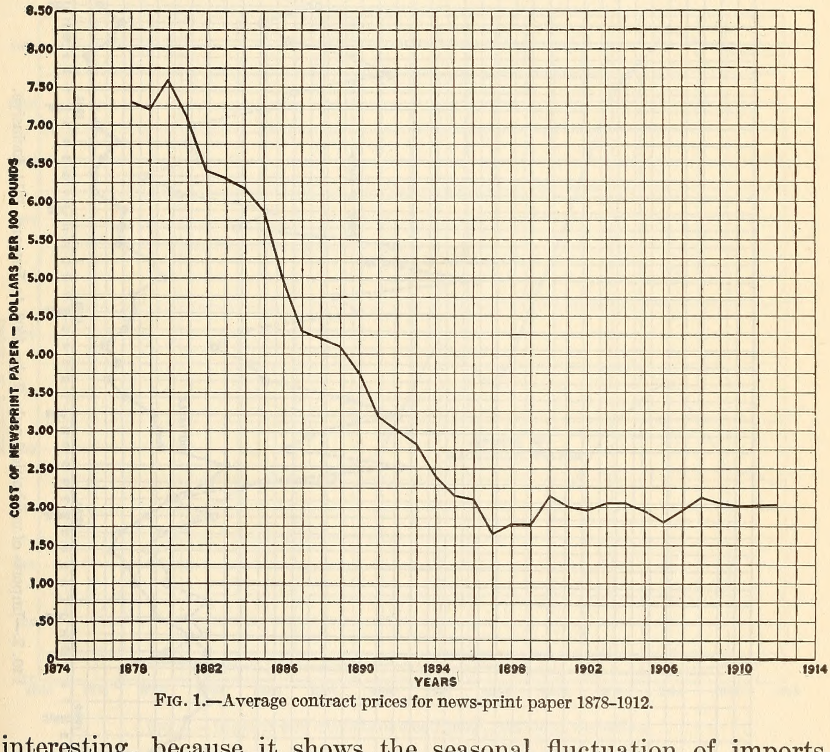


Fig. 1.—Average contract prices for news-print paper 1878–1912.

interesting, because it shows the seasonal fluctuation of imports. Figure 3 (curve *A*) shows the imports and exports of wood pulp, both mechanical and chemical. The increase in the amount of pulp imported is very marked, while the exports are comparatively small. It is evident from these curves that considerably more pulp will have to be manufactured at home before there can be any material expansion into the export trade.

Spruce furnishes by far the greater part of the wood at present used for mechanical pulp. Of the 1,314,141 cords consumed in the United States by the mechanical process in 1911, spruce supplied 1,121,703 cords, or 85 per cent, 822,743 cords of which were native

wood and 298,743 imported. Of the 4,328,052 cords of wood used in the United States in 1911 for pulp of all kinds, spruce furnished 2,505,730 cords, or 57 per cent.

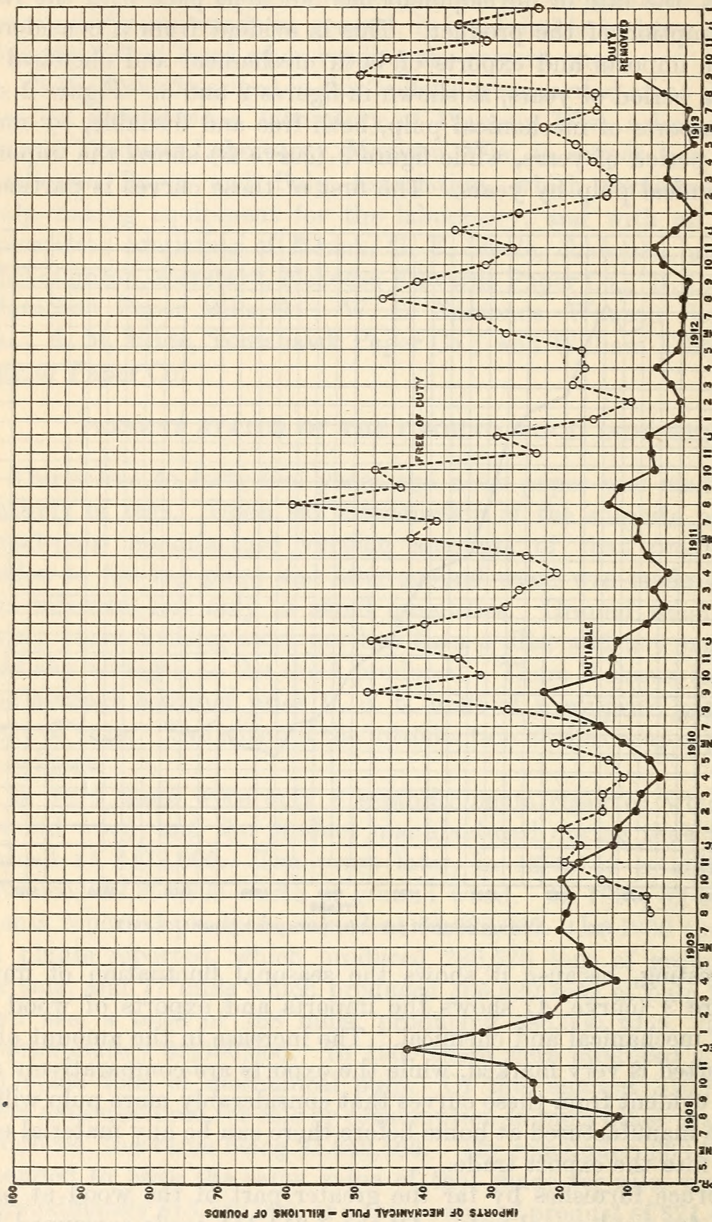


FIG. 2.—Imports of mechanical pulp, July, 1908, to January, 1914, inclusive.

The annual consumption of spruce in this country for all purposes is something like 2,575,000,000 board feet. The available stand east of the Rocky Mountains was estimated in 1907 to be 35,000,000,000

feet, with an annual increment due to growth of 770,000,000 feet. While it is probable that the maximum annual consumption of spruce for lumber has been reached, and that that for pulp wood will scarcely go much higher, it is nevertheless clear that with the maintenance of anything like the present annual consumption the spruce forests of this country are threatened with exhaustion. Nor is it likely that the American consumer of spruce wood will be able to draw to whatever extent he wishes upon the Canadian supply. In 1900 the Province of Ontario prohibited the exportation of unmanufactured wood cut on Crown lands within the Province, and later the Provinces

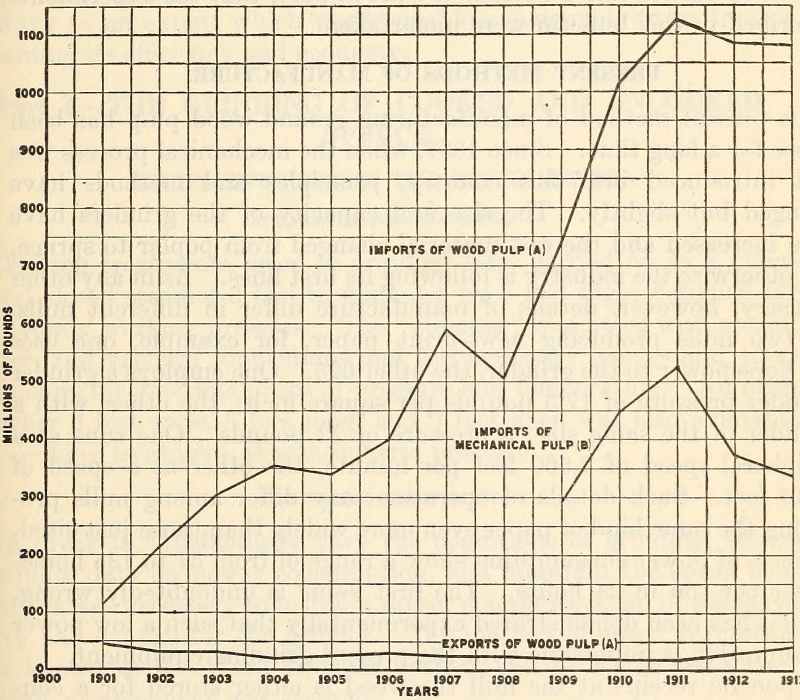


FIG. 3.—Imports and exports of wood pulp, 1901–1913, inclusive.

of Quebec (1909) and New Brunswick (1911) passed similar legislation. Further restrictive measures regarding the exportation of unmanufactured wood will undoubtedly be taken by Canada if the need arises.

The rise in the price of spruce over the 10-year period from 1900 to 1909, inclusive, reflects a steady increase in the consumption of mechanical pulp and a decrease in the available supply of the wood. In 1900 the average cost of spruce used for pulp-making purposes in the United States was $4.28 per cord for domestic and $6.50 per cord for imported material. In 1909 the average price for domestic spruce

had risen to $8.32 per cord, and for imported to $11.34 per cord. During the same 10-year period the average cost of manufacturing ground-wood pulp increased from $10.84 per ton to $16.58, by far the greater part of this increase being due to the greater cost of the wood used. Thus the manufacturer of mechanical pulp is faced with a steady increase in the cost of his raw material, and one which promises to continue if he must rely almost wholly upon a single wood. The great bulk of mechanical pulp produced is used in the manufacture of news-print paper, and the problem which presents itself is whether woods other than spruce can be used for the purpose. It was to answer this question, at least in part, that the experiments described in this bulletin were undertaken.

PRESENT METHODS OF MANUFACTURE.

The present method of manufacturing ground-wood pulp has been in use for a long time. Since 1867, when the mechanical process was first introduced into this country, principles and methods have changed but slightly. The size and capacity of the grinders have been increased and the raw material changed from poplar to spruce, but otherwise the industry is following its first lines. As in any other industry, however, details of manufacture differ in different mills. Of two mills producing news-print paper, for example, one uses 135 horsepower to the grinder, the other 625. One employs a grinder cylinder pressure of 17.5 pounds per square inch; the other, with a cylinder of the same size, a pressure of 72 pounds. One runs at a peripheral speed of 2,660 feet per minute, the other at a speed of 3,540 feet. Such details of operation may differ among mills producing the same kind of paper even more widely than those just cited. Reports of power consumption show a range of from 31 to 135 horsepower per ton in 24 hours. The first value is undoubtedly wrong, since it has been demonstrated experimentally that such a low power consumption is impossible with the present grinding equipment.

Upon its receipt at the mill the wood is either stored for a considerable time in the yard or else is ponded. Before storage the wood is sometimes cut into 2-foot lengths, or in other cases is rossed.

The grinders ordinarily take a pulp-stone approximately 54 inches in diameter by 27 inches face. Some stones recently installed are as large as 60 inches in diameter and 48 inches face. Up to a few years ago natural quarried stones were the only kind used in the grinding process, but many mills are now experimenting with artificial stones. The grinding is usually carried on under conditions of high temperature brought about by admitting only small quantities of water to the pit of the grinder. In the cold-grinding process, which is sometimes used in the United States and very largely adhered to in Europe, an excess of water prevents any heating.

Upon leaving the grinder a large supply of water is added to the pulp, and the mixture is then screened. If it is to be shipped over a long distance, the pulp is run into laps by means either of wet machines or of hydraulic presses. Occasionally the pulp is dried on steam driers and run into rolls. When pulp is used where it is produced, except for the need of storing to provide a supply in times of low water, it is thickened by means of feltless wet machines or deckers and immediately manufactured into paper.

In the last few years a magazine pulp grinder has come into use, equipped with two pockets which are filled automatically from the magazine. The machine, however, has not been operated in this country to an extent which would enable a judgment to be formed regarding its efficiency and economy.

Part I.—THE GRINDING OF COOKED AND UNCOOKED SPRUCE.

EQUIPMENT USED IN THE EXPERIMENTS.[1]

APPARATUS FOR COOKING.

Cooking treatments prior to grinding were carried on in a cylindrical closed steamer 3 feet in diameter by 8 feet high, designed for 75 pounds' working pressure. The "steamer" was fitted with steam, water, and vacuum connections and the necessary gauges and thermometers for determinations of pressure and temperature. An open steamer 6 feet wide, 8 feet long, and 3 feet deep was also available for cooking treatment at atmospheric pressure.

ELECTRICAL EQUIPMENT.

In order to satisfactorily vary the conditions of grinding, secure adequate data on power consumption, and maintain the speed constant, it was necessary to install a rather complex system of electrical drive and control for the grinder. The method of speed regulation was known as the Ward Leonard system, and by its means a very flexible arrangement was secured.

The installation consisted of a motor generator set of 460-kilovolt-amperes full-load capacity and a direct-current, variable-speed motor having a full-load capacity of 500 horsepower at 300 revolutions per minute. With the overload capacity it was possible to secure fully 75 per cent more power than the rating from each of the machines.

Three-phase 60-cycle electric power was applied to the synchronous motor of the motor generator set at 2,300 volts. The generator of the motor generator set was separately excited and by means of a rheostat

[1] A more detailed description of the equipment of the Forest Service laboratory at Wausau, Wis., is given in an unnumbered publication of the Forest Service, "Experiments with Jack Pine and Hemlock for Mechanical Pulp."

in the field circuit direct current could be generated at any desired voltage from 100 to 700 volts. The direct-current motor connected to the grinder was also separately excited and the speed of rotation controlled by regulating the voltage applied to the armature, the voltage control being brought about by variation of the field current of the direct-current generator. The speed of the grinder motor could be varied from 100 revolutions per minute to 300 revolutions per minute, the capacity with overload at the same time varying from approximately 340 horsepower to 750 horsepower.

The efficiency of the direct-current motor could be determined very readily by means of curves showing the stray power and heat losses at different speeds and current loads and knowledge of the power supplied to the motor. The latter data were obtained by means of accurately calibrated indicating and recording electrical instruments.

The various pieces of apparatus used in the manufacture of the pulp were driven by individual direct-connected motors. The apparatus for wood preparation, 40-inch swing saw, and "Green Bay" barker, together with the wet machine vacuum pump, were driven from a single-belted motor. Some of the individual motors were of the variable-speed type, and as a result the pieces of apparatus to which they were connected could be driven at the most effective speeds.

PULP MACHINERY AND AUXILIARY EQUIPMENT.

All of the pieces of machinery installed in the Wausau laboratory were of commercial size and design and were loaned either by manufacturers or others interested in the work being carried on.

The grinder was built by the Friction Pulley and Machine Works. It took a stone 54 inches in diameter by 27-inch face and had three 14-inch cylinders. Each cylinder was provided with a pressure gauge and the water was supplied by two triplex pumps. The pressure at which the water was pumped was regulated by relief valves; pressures as high as 120 pounds per square inch could be obtained.

A recording thermometer gave a record of the temperature in the grinder pit. From the grinder pit the pulp was passed through a mechanically agitated sliver screen, then pumped to a storage tank by means of a 5-inch centrifugal pump, and from there pumped to a centrifugal screen. A variable-speed motor direct connected to the screen made it possible to obtain speeds of rotation from 400 to 600 revolutions per minute. Throughout the tests, however, the speed was maintained at 500 revolutions per minute. The plate in the centrifugal screen was perforated with holes 0.065 inch in diameter.

The tailings from the centrifugal screen were rescreened through a 12-plate Harmon diaphragm screen, the plates used being the Union Screen Plate Co.'s type B, cut with 0.012-inch slots.

The screened pulps from the centrifugal and the flat screen were united and run out on an Improved Paper Machinery Co.'s 3-roll hydraulic wet machine. The white water from the wet machine was pumped back to the sliver screen of the grinder by means of a 4-inch centrifugal pump. White water from the felts was run to the sewer, as was also the white water from the felt suction.

PAPER-MAKING EQUIPMENT.

Portions of the pulps secured from experimental runs were sent to the Forest Products Laboratory at Madison to be run into paper. The apparatus available for the purpose when the earliest tests were made consisted of a pulp shredder, 12-pound Emerson beater, 2-plate flat screen slotted with 0.012-inch slots, and a 12-inch Fourdrinier paper machine. Later a Noble and Wood's jordan engine was added to the equipment. This was used only, however, in the preparation for the paper machine of pulps made from miscellaneous woods. The stock which was run on the machine in carrying on series tests to determine the effect of variable grinding conditions on the strength of pulp was not jordaned.

METHODS EMPLOYED IN EXPERIMENTAL TESTS.

PREPARATION OF WOOD.

All of the wood received at the laboratory was stored on skids in the yard and in most cases allowed to season before being used. It was received in several different forms; some cut from very large trees was split before shipping; some was rossed in the woods; but the greater part was in the form of round rough logs varying from 4 to 14 inches in diameter. The wood for test was sawed as required into 2-foot sections and barked, samples being taken for the determination of moisture and dry weight per cubic foot. The amount desired for the test was weighed and the diameter of each piece was measured. Tests were conducted as soon as possible after the wood was prepared and weighed.

In some cases it was necessary to remove knots before grinding, especially when the knots were likely to cause dirt in the pulp. This procedure was more often required for jack pine and aspen than for other woods.

In case the wood was to be treated it was piled in the steamer after having been carefully weighed. Depending on the conditions of the cook, the pressure was maintained constant at the desired value for different lengths of time. Cooks were made at steam pressures of from 5 to 75 pounds per square inch and for different lengths of time, from 1 to 12 hours. In some cases the wood was steamed and the condensation was drawn off as it formed; in others, the wood was immersed in water and boiled at different steam pressures, the

condensation being blown off as soon as the temperature fell below that corresponding to the steam pressure in use. In some cases, after cooking the required length of time, the charge was allowed to stand until it had absorbed a large amount of water. After unloading, the wood was weighed and then ground as soon as possible. In several instances samples were taken after cooking and the bone-dry weight and the moisture were determined.

GRINDING.

Before starting the test the desired surface was placed on the stone by means of a mechanically controlled burr or bush roll. The stone was then washed until free from loose sand and an impression of the stone was taken by means of carbon and coated paper. (See Forest Service Bulletin 127.) The grinder pockets were filled, the pressure adjusted to the correct value, the recording instruments were placed in operation, and the test was then started.

The speed and pressure were maintained as constant as possible throughout each test. Pocket binding was eliminated by the constant observation of power applied to the grinder, a falling off in power consumption with pressure on indicating binding. When a piston was raised, instead of allowing the speed to increase, it was held constant by regulation of the voltage on the motor armature.

In series tests in which the surface of the stone was not altered, but the speed, pressure, or temperature were, the data secured may be more or less open to criticism, since the surface undoubtedly changed slightly from one test to another. However, this change was very slight.[1] Likewise, in short tests it was impossible to heat up the stone thoroughly and here also a very slight error was introduced.[1]

During the tests readings were taken of power, speed, pressure, temperature, and the like, the intervals of reading being 15 minutes in most cases, although 5-minute intervals were sometimes employed.

LOSSES IN CONVERSION.

While it is highly desirable that the losses occurring in the barking of different woods be determined, it was impossible to investigate this point satisfactorily. Only small amounts of wood were used, in some cases not more than 8 cords, and determinations on such small amounts would not yield reliable results.

The amount of wood used during any test and the amount of wet pulp manufactured was accurately determined by weighing. Moisture samples were taken of both the pulp and the screenings and the bone-dry weight of each determined. In some cases the amount of wood fiber in the white water was secured by measuring the amount

[1] This point is discussed in more detail in Forest Service Bulletin 127, "The Grinding of Spruce for Mechanical Pulp."

of white water used and determining the wood fiber in a sample of it. This proved rather unsatisfactory, and was discontinued on account of the difficulty in removing the wood fiber from the white water sample.

The yield of pulp has been calculated to a basis of 100 cubic feet of solid rossed wood, this factor being thought more satisfactory and accurate than a measured cord, and representing approximately the solid content of a piled cord of 2-foot rossed wood containing 128 cubic feet.

TESTS ON THE PAPER.

The sample of pulp to be run into paper was first shredded and the moisture determined. The required amount was then weighed out and mixed and beaten with a weighed amount of bleached spruce slow-cook sulphite. In some runs, particularly those made on some of the pulps made from cooked woods, the sulphite was dispensed with. The mixture, usually 20 per cent sulphite to 80 per cent ground wood, was beaten until the fibers were separated, generally about 1 hour. The stock was then run out on the paper machine and an uncalendered sample was taken for strength and color tests.

No size, color, or loading was added to any of the sheets, the desire being to present the pulps made from different woods and under different conditions in as nearly comparable conditions as possible.

The uncalendered samples of paper were tested for tensile strength, lengthwise and crosswise, by means of a Schopper breaking length tester, and for bursting strength by means of a Mullen tester. The color tests were made with an Ives tintphotometer and measurements were made of the thickness of the sheet and weight per ream.

EFFECT OF PRELIMINARY TREATMENT OF SPRUCE.

Spruce has been used for many years as a raw material for ground-wood pulp, but the effect of the production of pulp from it under varying conditions has never been given very careful study. Depending on the quality of the product desired, different conditions of grinding must be selected, and in some cases the wood must even be given a cooking treatment prior to grinding. In the manufacture of container board, where great strength is desired and the color is of lesser consequence, strength is often increased by the addition of sulphite or sulphate pulp, screenings, or old paper stock. In the manufacture of news print paper, strength is desired too, but not nearly so much strength, the color, yield, and finishing characteristics here being the prime consideration. The work which has been done on spruce has been carried on with the idea of attempting to increase the efficiency of grinding both from the standpoint of reducing the power consumption and increasing the yield from a cord of the raw material in either the cooking or ordinary ground-wood process, and

to ascertain the influence on the quality and quantity of pulp produced by the variation of the grinding variables, such as surface of the stone, pressure on the cylinders, speed, temperature, etc.

The cooking of wood prior to grinding is attended with a number of changes in the physical characteristics of the wood which greatly influence the quality of the pulp manufactured from it. The cooking condition must be chosen according to the use to which the pulp is to be put. For the manufacture of news-print paper from pitchy woods it is essential that the treatment be a very mild one, and that the duration of boiling or steaming and the temperature at which it is carried on be such as to allow of the fiber being as light in color as possible. Either the pressure, or corresponding temperature, must be low and the cook of long duration, or the pressure higher and the

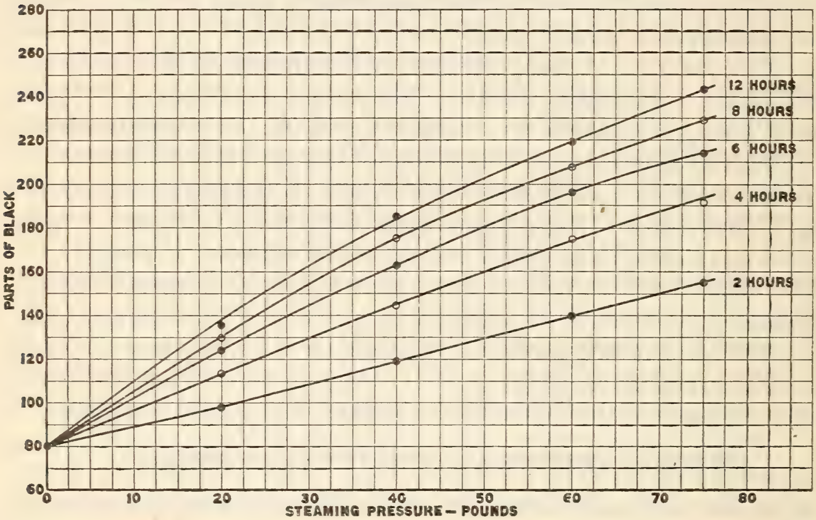


FIG. 4.—Effect of steaming pressure on color of pulp (average values of several runs on spruce).

cook of much shorter duration. It is generally claimed that cooking the wood under pressure while immersed in water will yield a lighter pulp than steaming at the same pressure and for the same length of time, but this result has not been noted.

Boiling wood has certain disadvantages which are not found when the steaming process is used. There is a considerable loss of heat, and it is necessary to draw off condensed liquors to maintain the temperature at any desired value. This makes it necessary to pay greater attention to the process. If the temperature and duration of the cook are the same, the steamed or boiled wood should be practically the same in color and other physical characteristics. One decided advantage of steaming is the possibility of draining off the condensed liquors in a concentrated form. This is of great benefit when by-products are to be recovered.

In all of the experiments conducted in cooking wood prior to grinding, the temperature corresponded to the temperature of boiling at the steam pressure under which the cook was being made. Attempts were made to secure by-products, but the amounts of wood used were so small that this could not be done satisfactorily.

INFLUENCE OF PRESSURE, TEMPERATURE, AND TIME OF COOKING.

When the length of time of the cook is kept constant and the cooking pressure or temperature is varied, it is found that the color of the pulp made darkens greatly when these factors are raised, all other conditions being the same. This is demonstrated by reference to the

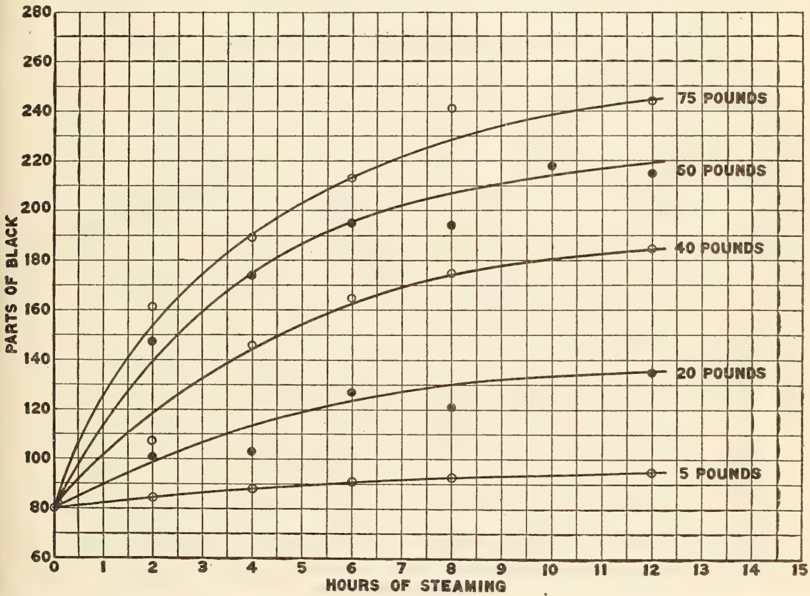


FIG. 5.—Effect of duration of steaming on color of pulp. (Average values of several runs on spruce.)

curves in figures 4 and 5, where the amount of black in the color as determined by a tintphotometer is plotted against the cooking pressure and temperature. At some steam pressure the wood will char and the resultant pulp will be black; under this condition a maximum of 300 parts black would be secured. It is probable that this steam pressure would not be very high, since the values of parts of black increase rapidly after 60 pounds pressure is reached.

The strength of the pulp increases with the length of the steaming period (fig. 6) and seems to reach a maximum in about 8 hours for both pressures. In figure 7 is shown the variation of the yield of pulp per 100 cubic feet of solid rossed wood, with the pressure of steaming and the duration of the cook. The marked effect of the duration of the cook, especially at high pressure, is evident. The yield decreases

rapidly with increased pressure due to the dissolving action of the water and the transformation of portions of the wood into water soluble material which is washed out in the grinding process.

Variation of the period of cook also has a marked influence upon the horsepower consumption per ton of pulp. When wood is ground under the same conditions of grinder pressure, speed, temperature, etc., it is found that after a period of four to six hours of cooking the maximum value of power consumption is obtained. For a greater

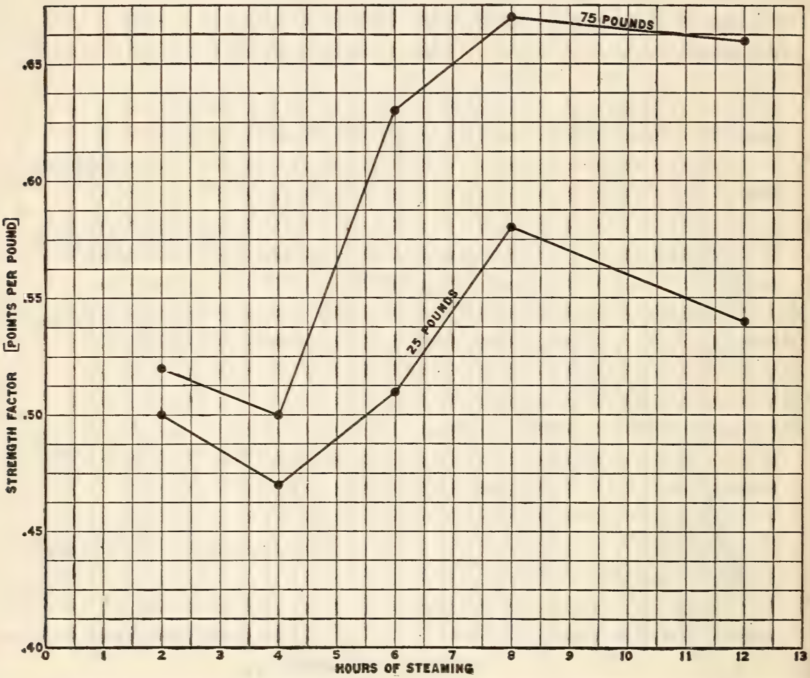


FIG. 6.—Effect of duration of steaming upon the strength of the pulp. (Spruce runs 199–209, inclusive.)

or lesser length of time of cooking the horsepower consumption per ton decreases (fig. 8).

OTHER FACTORS.

The variation of the yield of pulp from 100 cubic feet of solid wood with the duration of cook and temperature of cooking has been pointed out. It would seem that most of the loss would occur in the cooking process itself, but determinations of the amount of bone-dry wood charged to the cooker and the amount of bone-dry material taken from it after steaming shows that the loss in cooking as volatile materials and water-soluble substances which leach out when the wood is in the 2-foot lengths is remarkably low, being from 5 to 8 per cent. It appears that the great loss which takes place in the produc-

tion of steamed wood pulp occurs in the grinding process, either due to the dissolving of material which has been converted to a soluble state or the grinding of the softer portion of the wood—the springwood—to flour and the subsequent loss of it in the white water. There is a characteristic odor of burned sugar during the steaming of wood, and possibly some of the wood fiber is converted into sugar.

The condensed liquor from the steamer has a very corrosive action on the iron and it is possible that in order to satisfactorily protect

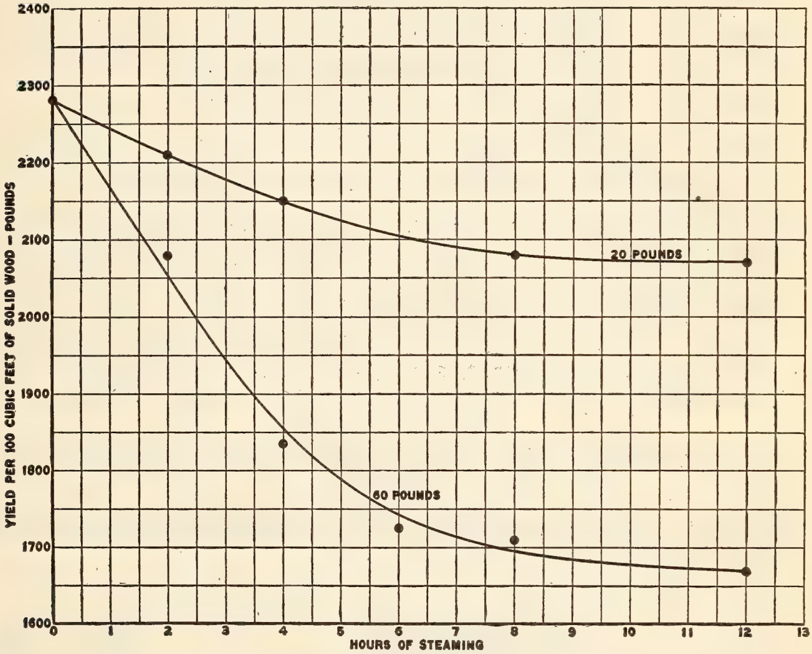


FIG. 7.—Effect of duration and pressure of steaming on the yield of pulp. (Spruce runs 103 to 107 and 114 to 119, inclusive.)

the metal it might be desirable to add small quantities of sodium carbonate to the water when the boiling process is used. This, of course, would not apply when the wood is steamed.

The liquors which condense during the steaming of the woods may have considerable commercial value, particularly when resinous woods are used. The equipment employed in the Wausau laboratory was not of sufficient capacity to make it possible to study this problem carefully, but an indication of the nature of the condensed liquor can be obtained from the following analyses of material secured from a mill steaming wood commercially, in which case approximately 5 cords of wood were used for each charge. Unfortunately no means were available for measuring the total condensed

liquor, and for that reason the amount of the materials can not be expressed in quantity per cord.

It will be noted that two samples were analyzed, one of which was a residue from evaporation of a condensed liquor and the other a sample of the liquor from another cook. The woods steamed were a

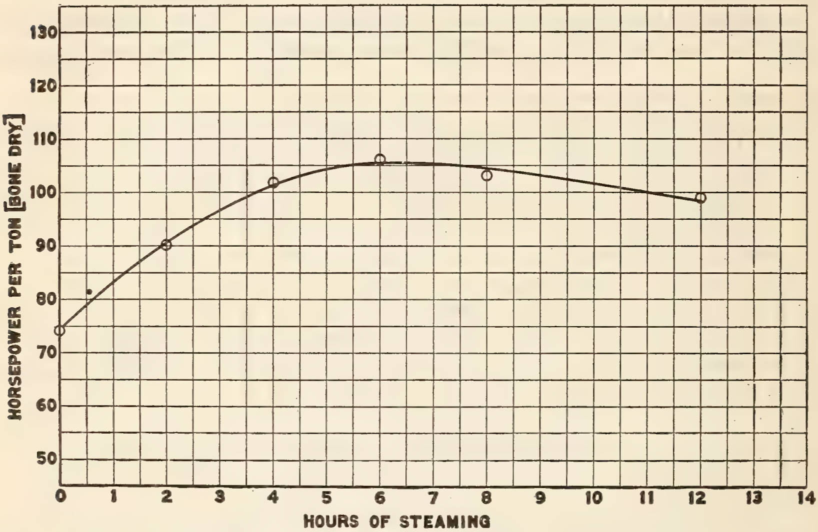


FIG. 8.—Effect of duration of steaming on power consumption per ton of pulp. (Spruce runs 114–119, inclusive.)

mixture of jack pine and tamarack in the ratio of 67 per cent of the former to 33 per cent of the latter.

	Residue from evaporation of liquor.	Sample of liquor.		Residue from evaporation of liquor.	Sample of liquor.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
Total solids	....	2.05	Ash	9.85	0.049
Soluble solids	70.10	1.95	Acetic acid (total)	5.71	.162
Reducing sugars	15.89	.83	Formic acid (total)	1.41	.042
Tannins	13.60	.092	Moisture	4.31	97.95

The total and soluble solids and tannin were determined according to the methods outlined by the American Leather Chemists' Association.

The boiling or steaming of woods results in the formation of a natural size from the wood substance or some of its constituents. This sizing action is particularly noticeable in the production of pulps from the hardwoods—birch and aspen—which are not pitchy. All paper produced from cooked woods, pulped by the mechanical process, show the characteristic water-resistance qualities and hardness of hard sized papers.

Tests on papers made from steamed and unsteamed woods show that the unsteamed pulps do not give as high percentage stretch as the steamed, even though the unsteamed pulps were mixed with 20 per cent of bleached spruce sulphite. Pulps made from cooked woods should be given satisfactory beating treatments to make them usable for different purposes. Like chemical pulp, there is a marked influence on the resultant paper when the pulps are given different beating treatments. The sheets become more brittle after a prolonged beating, but give high strength tests.

THE EFFECT OF GRINDING STEAMED AND UNSTEAMED WOODS UNDER VARIABLE CONDITIONS.

SURFACE OF STONE.

There is shown in figure 9 a series of curves on steamed and unsteamed woods which were conducted on different surfaces of stone. It is evident that the horsepower consumption per ton when steamed wood is used decreases to a minimum value at a grinder pressure of approximately 65 pounds per square inch on a 14-inch cylinder, regardless of the surface which is used. The contrast in the form of the curves for steamed and unsteamed wood is shown in this same figure. Curves 2 and 3 were run under exactly the same conditions, except that in one case steamed wood and in the other unsteamed wood was used as a raw material.

Upon the condition of the surface of the pulp stone depends, to a great extent, the power consumption per ton of pulp made, the rate of production, and the quality of the resultant material. The pulp stone used in the tests was burred in many different ways, and it was generally found that if the grit were brought to the same condition of sharpness, the power consumption, rate of production, and quality of pulp would be practically the same. When the stone is rough but the sand particles are not sharp, a coarser pulp is produced which acts more free on the wire of the paper machine. It was also found that regardless of the degree of sharpness of the stone it was impossible to obtain pulp for news print if the expenditure of power remain 50 horsepower per ton.

Figure 10 shows by curves obtained at different pressures the relation of three different surfaces of stone to the power consumption per ton, power to the grinder, and production in 24 hours. These typical curves show how greatly the above-mentioned factors are influenced by varying the sharpness of the pulp stone.

Plates I and II show the effect of different degrees of sharpness of stone on the quality of pulp produced as represented by the character of fibers. Plate I, figure 1, shows the fiber produced on the sharper medium grit stone with the consumption of a small amount of power,

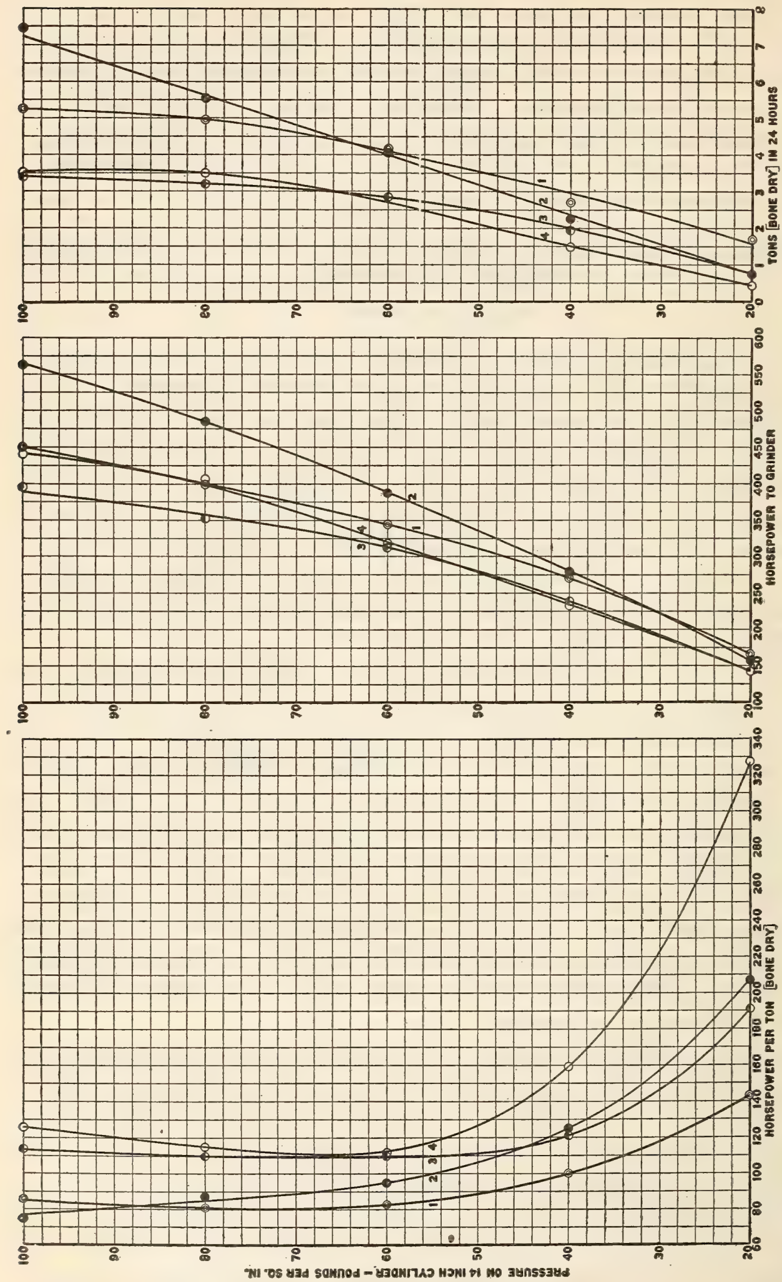


FIG. 9.—Relation of power consumption and rate of production to pressure. 1. Steamed spruce runs 182–187, inclusive. 2. Unsteamed spruce runs 177–181, inclusive. 3. Steamed spruce runs 172–176, inclusive. 4. Steamed spruce runs 167–171, inclusive.

while figure 2 shows that the consumption of a greater amount of power on a duller stone yields a much finer and better fibered pulp.

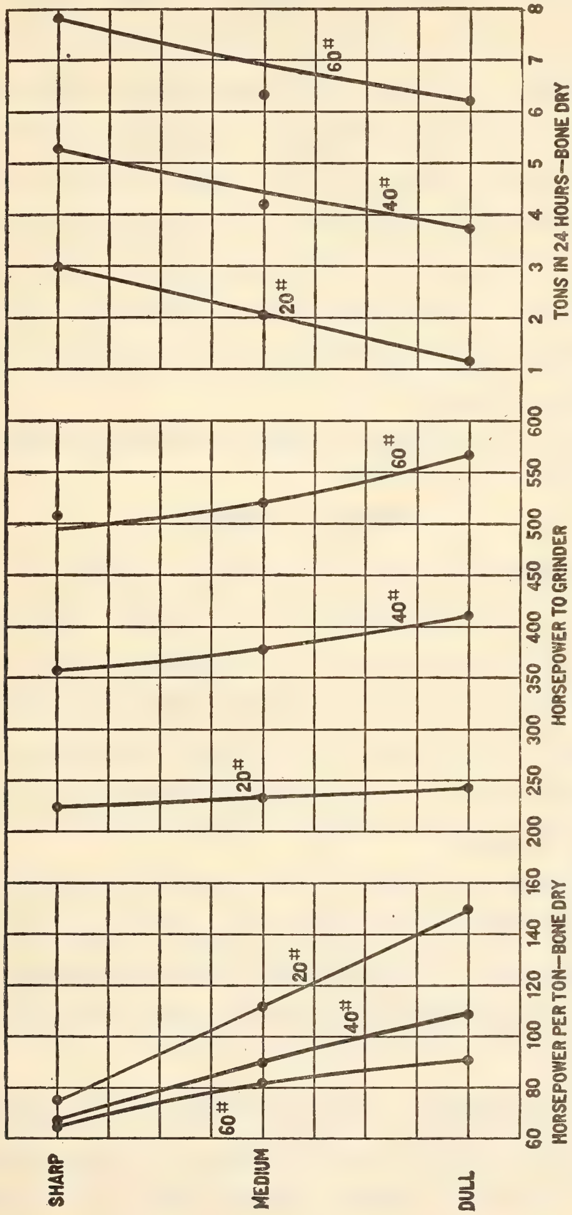


FIG. 10.—Relation of power consumption and rate of production to sharpness of stone. (Spruce runs 6 to 8, 12 to 14, and 18 to 20, inclusive.)

The fibers in Plate II, figure 1, were produced on a stone having a degree of sharpness between the above two, and those shown in figure 2 were obtained on a sharp, coarse grit stone.

GRIT OF STONE.

If a stone of coarse grit is used considerably less dressing with the burr is necessary to attain the conditions of a sharp stone. In fact, it is difficult to produce a pulp that is not coarse and full of shives. Although a somewhat lower consumption of power per ton of pulp is easily obtained, on account of its coarseness the pulp is not satisfactory from a news-print standpoint. The yield of screenings is much greater, as one would anticipate. As indicated by the Mullen tester, the strength of pulp ground on a coarse grit stone is a trifle less than when made on a finer grit stone and consuming the same amount of power per ton; but when compared as to their respective breaking lengths, there is no difference. However, when the wood is steamed prior to grinding, a strong pulp may be obtained at lower horsepower consumption on the coarse grit stone than on a finer one. A comparison of the grits of the stones may be obtained by referring to Plate III, figures 1 and 2.

In general, a stone of fine grit yields a fine-fibered pulp and a coarse stone a shivy and coarse pulp.

PRESSURE OF GRINDING.

In any commercial grinder the pressure at which the wood is forced upon the revolving grindstone—that is, the pressure per square inch of wood surface in contact—varies greatly. The variations in pressure are brought about by the binding of the wood in the pockets; the grinding of wood of different lengths and diameters; the variation of pressure on the grinder cylinder, due to the removal of pressure from one or more of the cylinders, and the use of varying amounts of split wood. For any cylinder pressure, however, it is reasonable to assume that the pressure per square inch on the stone varies between certain limits.

Figure 11 shows the relation of the pressure on the grinder cylinder, the horsepower consumption per ton, power to grinder, and production in 24 hours, the three curves being obtained on surfaces of different degrees of sharpness. It will be noted that with increasing pressure the horsepower consumption per ton decreases, and that the horsepower to the grinder and production in 24 hours increases at a fairly definite rate.

The yield and quality of pulp produced vary to a considerable degree with the pressure of grinding. Finer, although shorter-fibered, pulps are obtained when grinding at higher pressure, the advantage of the use of higher pressure being that it is possible to use a duller stone and obtain finer-fibered pulp with a consumption of the same amount of power as would be used at lower pressure and sharper condition of the stone.

F-LAB. 4

FIG. 1.—SPRUCE MECHANICAL PULP (RUN NO. 11).

F-LAB. 5

FIG. 2.—SPRUCE MECHANICAL PULP (RUN NO. 5).

F—LAB. 6

FIG. 1.—SPRUCE MECHANICAL PULP (RUN NO. 17).

F—LAB. 7

FIG. 2.—SPRUCE MECHANICAL PULP (RUN NO. 275).

F-LAB. 8

FIG. 1.—MEDIUM GRIT PULPSTONE.

F-LAB. 9

FIG. 2.—COARSE GRIT PULPSTONE.

Figure 12 shows the effect of increasing pressure on the yield per 100 cubic feet of solid rossed wood. There is a material increase in

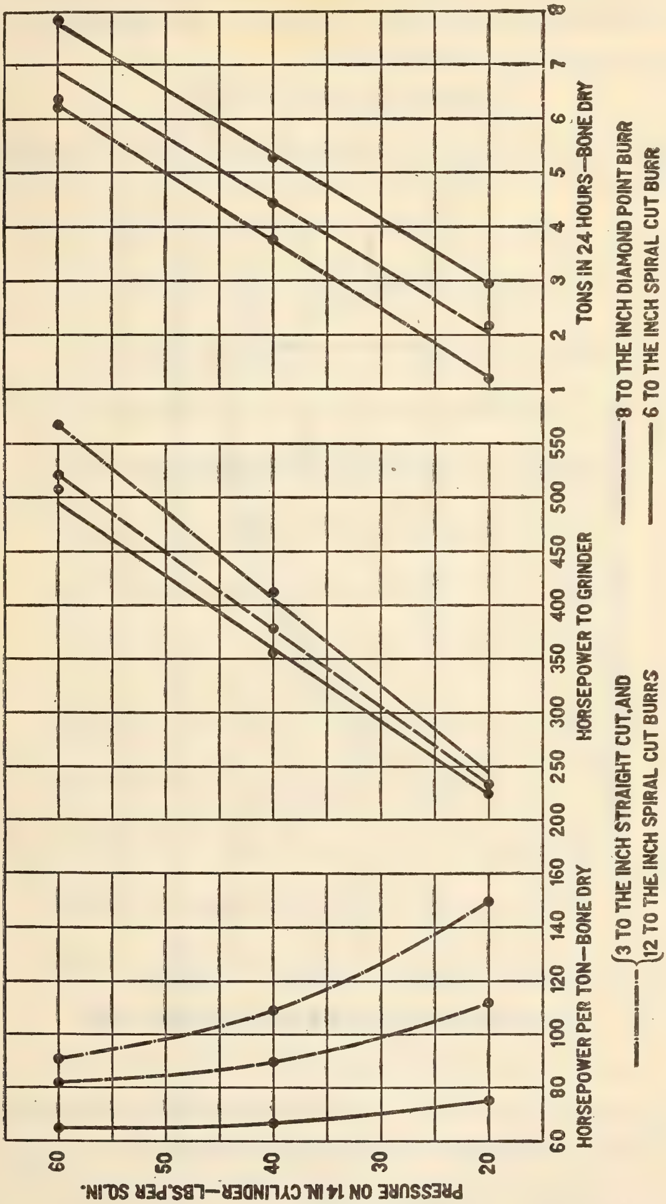


Fig. 11.—Relation of power consumption and rate of production to pressure. (Spruce runs 6 to 8, 12 to 14, and 18 to 20, inclusive.)

the amount of pulp produced from this quantity of wood if the pressure of grinding is increased from 20 pounds per square inch on a 14-inch cylinder to 100 pounds.

The effect of pressure on the quality of pulp as indicated by the strength of paper made from it is shown in figure 13. The strength factor, or bursting strength per square inch divided by the weight per ream, decreased with increasing pressure. The decrease in power consumption per ton is also shown.

PERIPHERAL SPEED OF STONE.

In figure 14 is shown the variation of the horsepower consumption per ton, horsepower to the grinder, and production in 24 hours, with

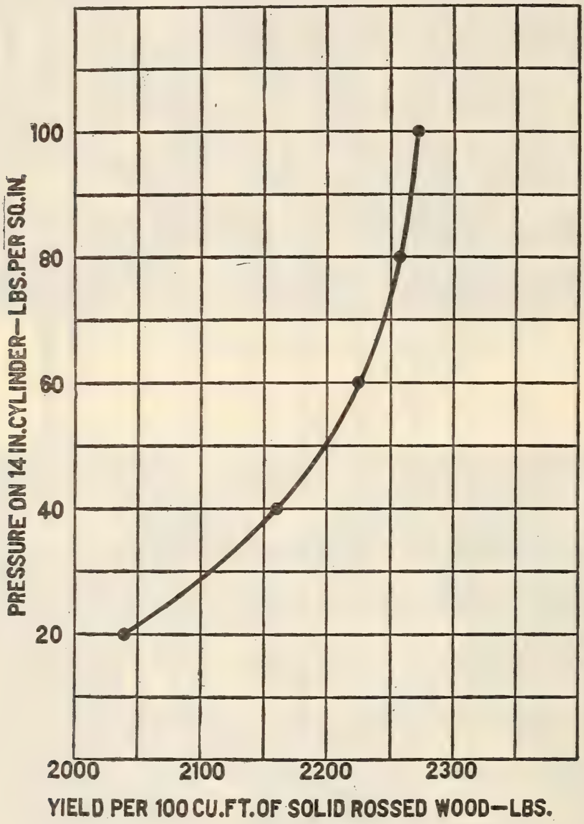


FIG. 12.—Relation of yield to pressure. (Spruce runs 52 to 56, inclusive.)

varying speed of pulp stone. The decrease in the power consumption per ton from 100 to 250 revolutions per minute when steamed wood is used is much greater than when unsteamed wood is ground under the same conditions. (See fig. 15.)

The pressure at which wood is steamed prior to grinding has a marked influence on the speed of rotation of the pulp stone necessary to consume a certain amount of power when the grinding pressure is maintained constant. This is shown in figure 16. The wood was

steamed at varying pressures for periods of three and six hours and then ground in two pockets of the grinder at a cylinder pressure of 60 pounds per square inch. The power to the grinder was maintained at 345 horsepower, and it was utilized by adjusting the periph-

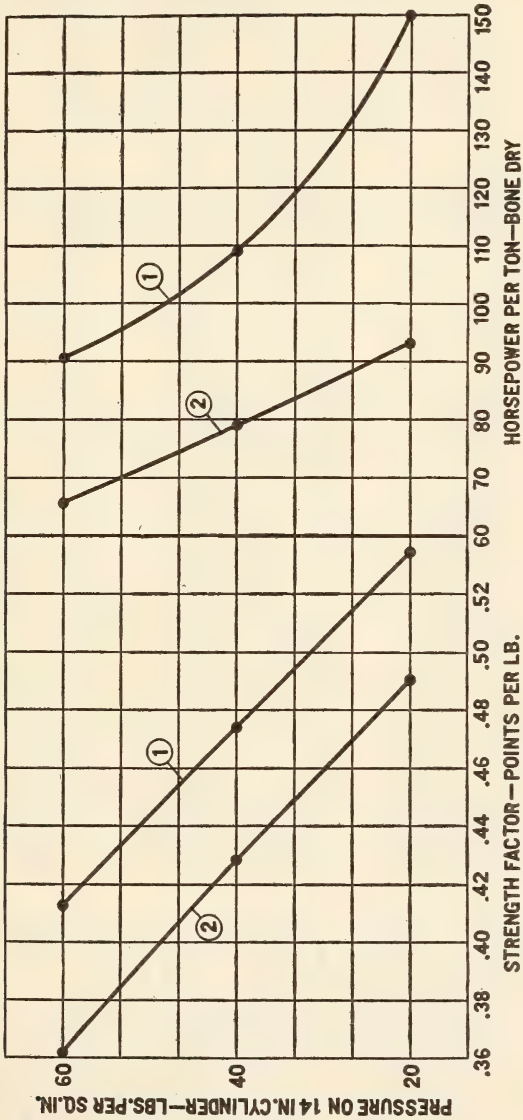


FIG. 13.—Relation of strength of paper and power consumption to pressure. (1) Spruce runs 9-1 to 11 and (2) 6 to 8, inclusive.

eral speed of the stone to such a value as was necessary for the sample being tested. When wood which had been steamed for 6 hours at 75 pounds pressure was ground a cylinder pressure of 60 pounds on two pockets and speed of 225 revolutions per minute were necessary

to consume the 345 horsepower. When the wood was steamed for 6 hours at 20 pounds, a cylinder pressure of 60 pounds and speed of 187 revolutions per minute were necessary to use up the power.

There are shown in figure 17 the relation of horsepower consumption per ton, horsepower to the grinder, and production in 24 hours to the steaming pressure when wood, which had been cooked at different pressures, was ground at constant cylinder pressure and varying speed of rotation of the pulp stone. It will be noted that the horsepower consumption per ton increases with the speed, corresponding

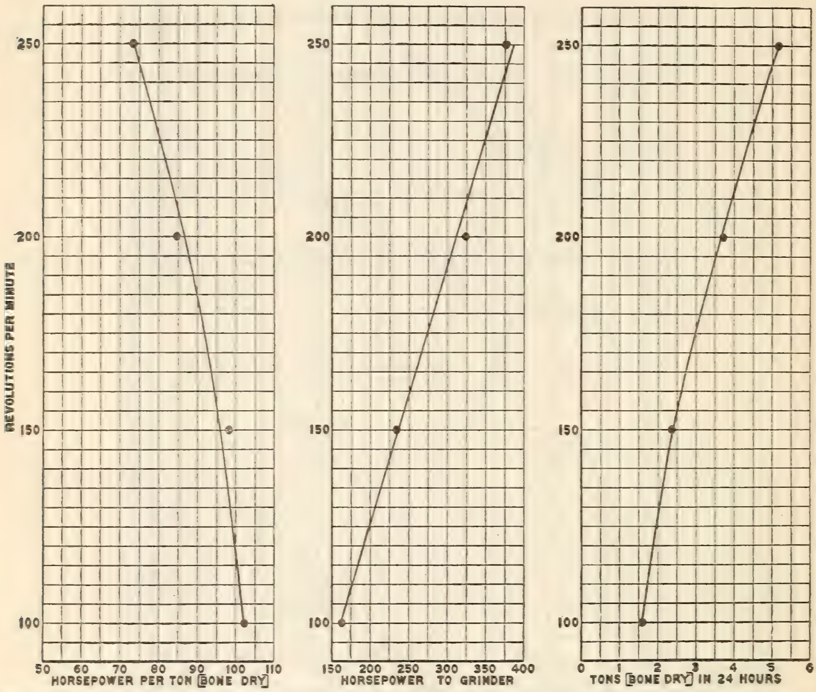


FIG. 14.—Relation of power consumption and rate of production to speed. (Spruce runs 188 to 191, inclusive.)

to increase in the pressure of steaming, and this increase is due to a reduction in the rate of production of the pulp.

When wood is steamed for a certain number of hours and at a fixed pressure, then ground with a certain amount of power to the grinder but under varying speed of rotation of the pulp stone, it is found that the horsepower consumption per ton increases in a similar manner to that given in figure 18. In other words, at low speed and high pressure more power is necessary to grind a ton of pulp in 24 hours than at high speed and low pressure. This is due, again, to the reduction in the rate of production.

The peripheral speed of the pulp stone influences the power consumption only slightly. The power consumption per ton decreases somewhat when the speed is increased (fig. 15). It is also shown that

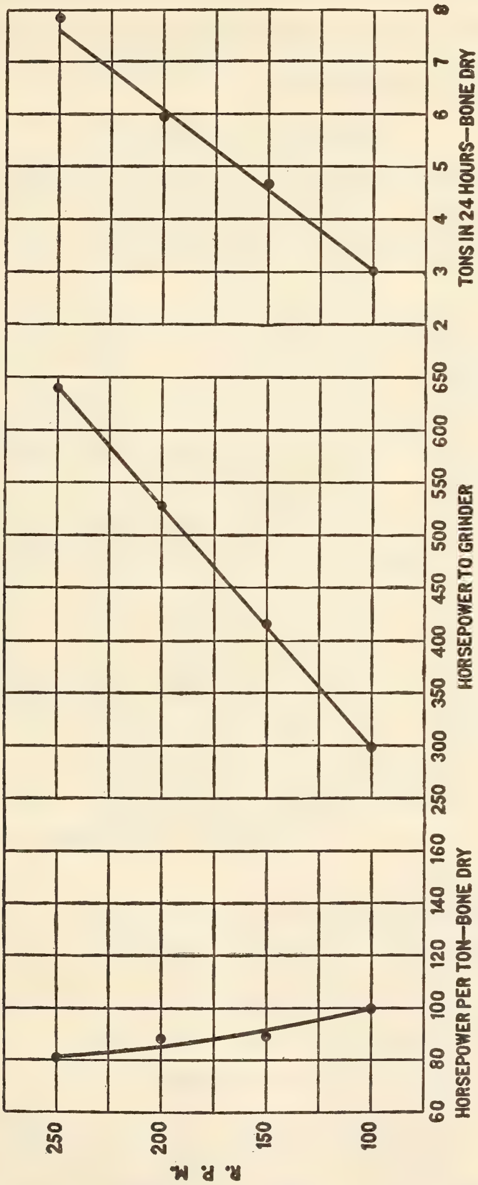


Fig. 15.—Relation of power consumption and rate of production to speed. (Spruce runs 24 to 27, inclusive.)

the horsepower to the grinder and production in 24 hours increase directly with the speed of the pulp stone. The speed has much less effect upon the quality of the pulp than either the pressure or surface

of the stone. Stronger pulp is obtained, however, at conditions of low speed and high pressure than is obtained at conditions of high speed and low pressure. It is believed, however, that the pressure is more responsible here than the speed. Figure 19 shows that the strength of paper, when the same amount of power is applied, is much less when the power is utilized at high speed and low pressure than at high pressure and low speed.

TEMPERATURE OF GRINDING.

There has always been more or less discussion about the effect of grinding hot or cold. Throughout the experimental work discussed little influence has been noted in grinding under conditions of varying temperature. It is true that the production in 24 hours is less when

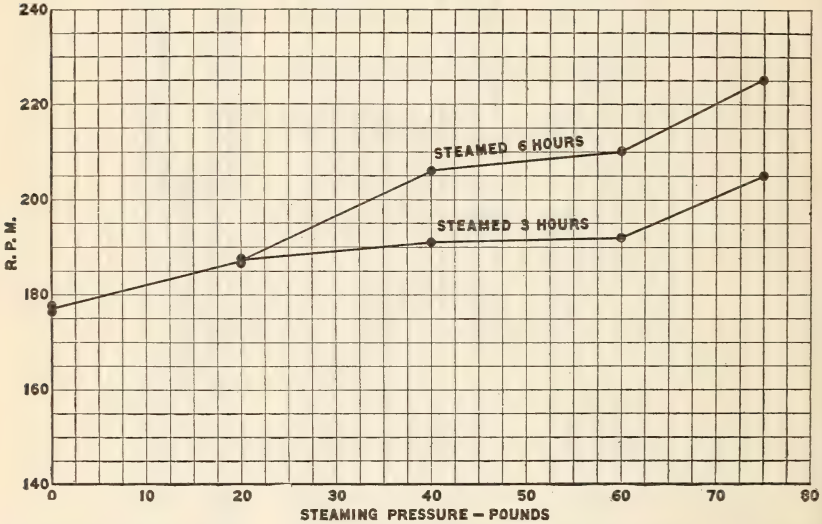


FIG. 16.—Effect of steaming pressure on speed—horsepower to grinder constant. (Spruce runs 233 to 242, inclusive.)

grinding cold than when the hot process is used, but the variation of the temperature from 125° to 190° F. does not materially influence the rate of production. The pulp is somewhat finer when ground cold, but there is not as much difference between pulps manufactured by the cold and hot processes as is generally believed.

OTHER FACTORS.

Among the other factors which influence the power consumption, production in 24 hours, and the quality and yield of pulp are the amount of seasoning the wood has undergone before grinding, the dry weight per cubic foot, the size of bolts, and the rate of growth.

It is easier to grind green wood and secure a satisfactory pulp than it is to grind seasoned wood. Seasoned wood almost invariably

yields a shorter fibered pulp, with a color inferior to that obtained from the green material. Green wood likewise requires less power to grind it, although the difference in the power consumption per ton between that obtained from green and seasoned wood is very small.

The weight per cubic foot of wood is a most important factor, since upon it depends almost entirely the yield per cord. This is best shown in figure 20, where the dry weights of a number of different species are plotted against the yield of pulp per 100 cubic feet of solid rossed wood. It has been found that the yield is almost directly proportional to the bone-dry weight per cubic foot.

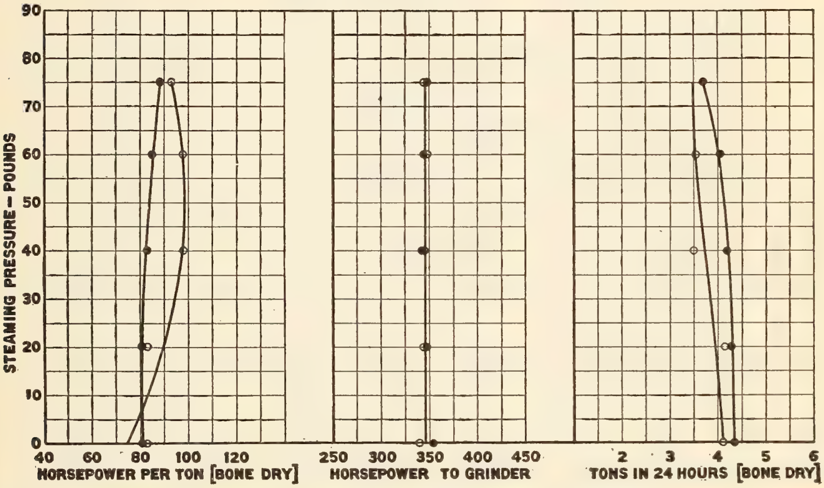


FIG. 17.—Relation of power consumption and production to steaming pressure—horsepower to grinder constant. (Spruce runs 233 to 242, inclusive.)

The following is a list of woods corresponding to the numbers shown on the curves in figure 20:

No. 1. Balsam fir.
2. Red fir.
3. White fir.
4. Alpine fir.
5. Amabilis fir.
6. Lowland fir.
7. Noble fir.
8. Eastern hemlock.
9. Western hemlock.
10. Tamarack.
11. Western larch.
12. Montana lodgepole pine.
13. California lodgepole pine.
No. 14. Western yellow pine.
15. Jack pine.
16. Loblolly pine (fall cut).
17. Loblolly pine (spring cut).
18. White pine.
19. Engelmann spruce (Montana).
20. Engelmann spruce (Colorado).
21. Sitka spruce.
22. White spruce.
23. White birch.
24. Aspen.[1]
25. Black gum.

[1] Commonly called "popple" in Wisconsin.

The rate of growth seems to have little effect upon the power consumption or rate of production. When the wood is of large diameter it is necessary to split a considerable portion of it and more or less binding is caused, this resulting in a higher power consumption per ton of pulp. The yield and quality are both slightly influenced by the rate of growth of the wood. The yield is lower from wood of rapid growth than from wood which has grown slowly. The pulp is softer when rapid-growth wood is used, although the strength is practically the same. Generally woods which are highly lignified

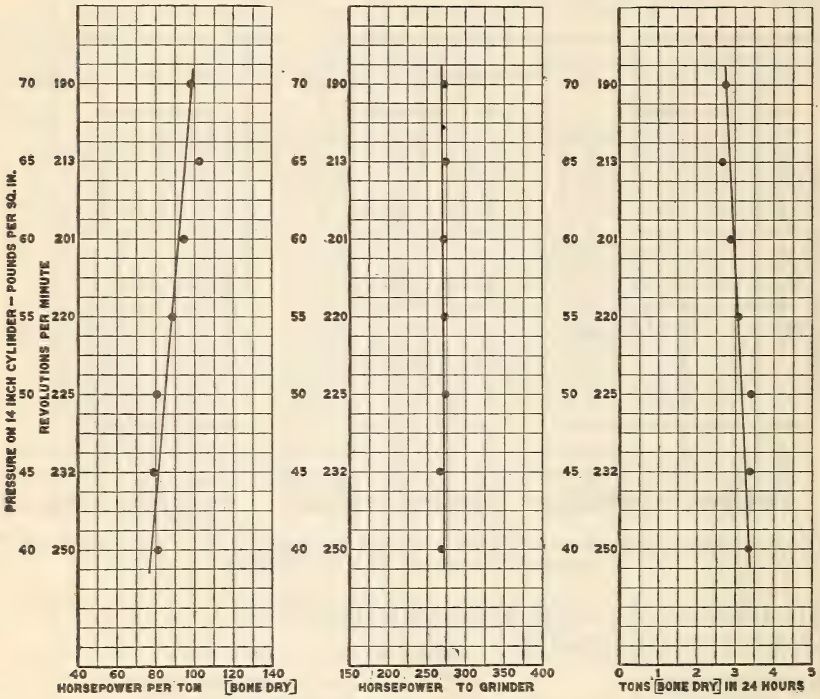


FIG. 18.—Relation of power consumption and production to pressure and speed—horsepower to grinder constant. (Tamarack runs 62 to 68, inclusive.)

yield shorter fibered pulps than those having large amounts of sapwood.

The condition of the wood as regards decay has a marked effect on the pulp. With the use of partially decayed wood the yield of pulp from a cord is greatly decreased, and while the wood grinds faster than entirely sound wood, giving an increased production and a correspondingly lower power consumption per ton of pulp, the pulp consists principally of extremely short fibers and wood flour, which greatly decrease its strength. (Spruce runs 255 and 256.) At the same time the color is materially darker than that of the pulp produced from sound wood.

POWER CONSUMPTION PER UNIT OF STRENGTH.

It has always been known that the consumption of a great amount of power will produce pulp of a greater strength. The relative effect, however, in using different amounts of power is probably best shown in figure 21. The strength as represented by Mullen or Schopper tests increases with increasing power consumption per ton.

Figure 22, curve *A*, shows the relation between horsepower consumption per ton of pulp per meter of breaking length of paper made

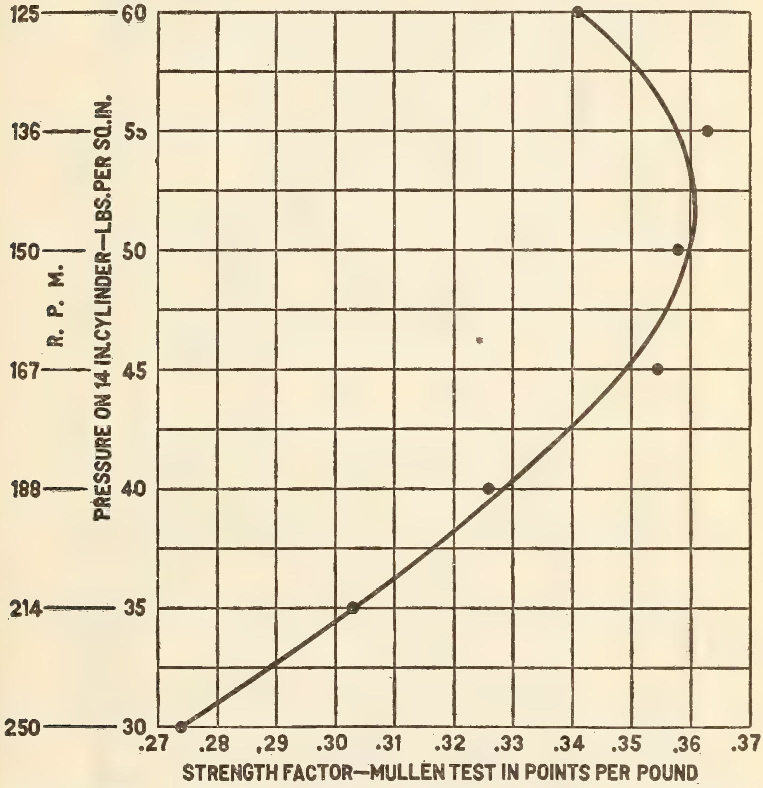


FIG. 19.—Relation of strength of paper to pressure and speed. (Spruce runs 32 to 38, inclusive.)

from it, and the power consumption in grinding a ton of the pulp. At low values of power consumption greater strength is produced per horsepower than at high values. The horsepower per ton per point per pound is also shown in the same figure, curve *B*.

STEAMED WOOD PULP AND ITS USES.

The pulp made by grinding steamed wood can be used for different purposes, depending largely upon the nature of the grinding process. If a sharp and coarse stone is used a large number of shives will be present and the pulp will serve for the manufacture of box board or

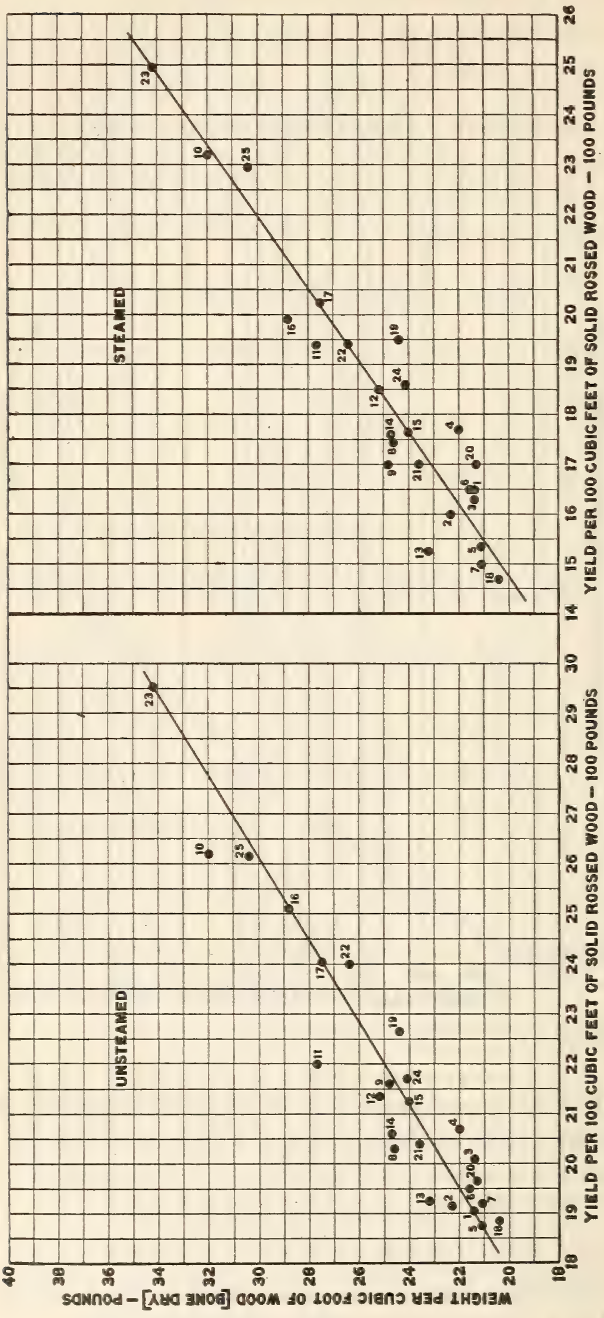


FIG. 20.—Relation of yield to dry weight of wood—steamed and unsteamed.

similar materials. When ground to a finer state, however, it has been demonstrated that with a mixture of a small amount of chemical fiber bogus kraft paper can be produced which will serve for a cheap

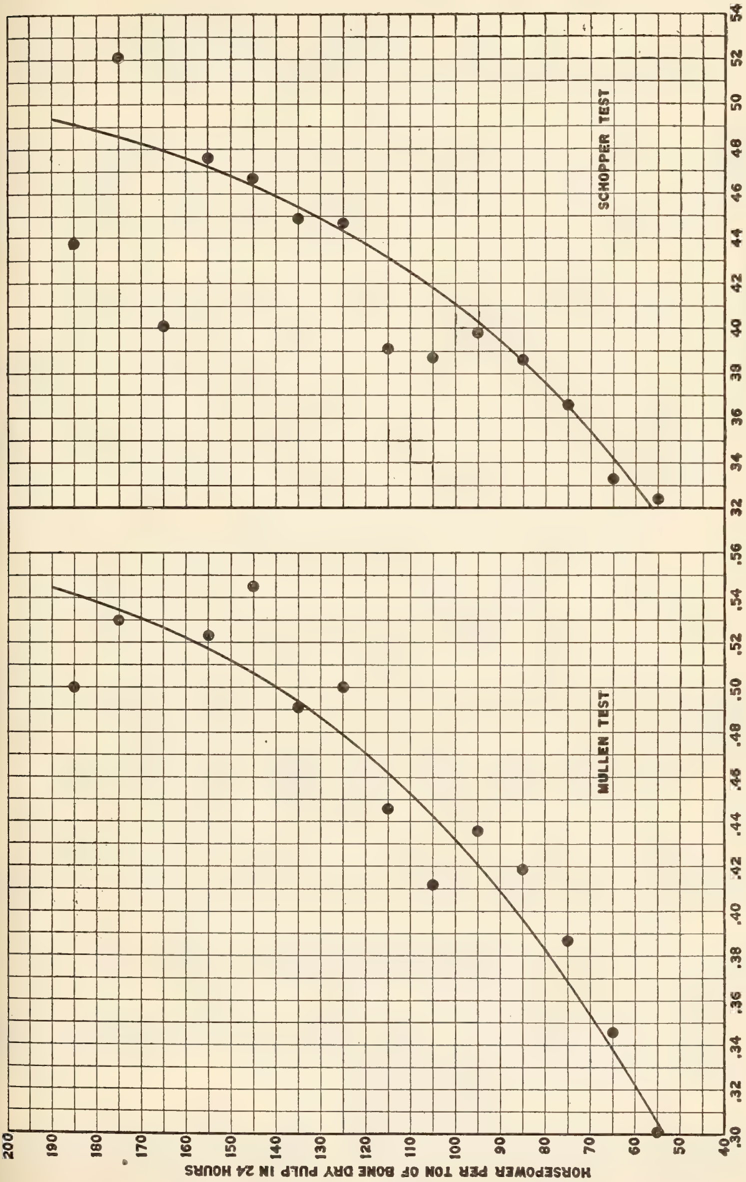


FIG. 21.—Relation of strength of paper to power consumption per ton of pulp. (Average of all tests on spruce.)

wrapping paper. It is hardly likely that spruce could be used for the manufacture of cheap wrapping paper in this manner on account of its price, but other woods, which will be discussed later, also give

remarkably good results, and, being available in large quantities, should serve as a raw material for this purpose. Tests made on sheets composed entirely of boiled and steamed ground-wood pulp show that wrapping papers which will test from 0.50 to 0.75 of a point to the pound are easily produced. Wrapping papers of this kind are inclined to be brittle and do not have sufficient strength in tearing or folding without the addition of a small amount of chemical fiber.

Resinous woods, if given a mild steaming or boiling treatment prior to grinding, are rendered much more free from pitch, although the pulp is made very soft and darkened to some extent. The use of this method for the production of news print paper would undoubt-

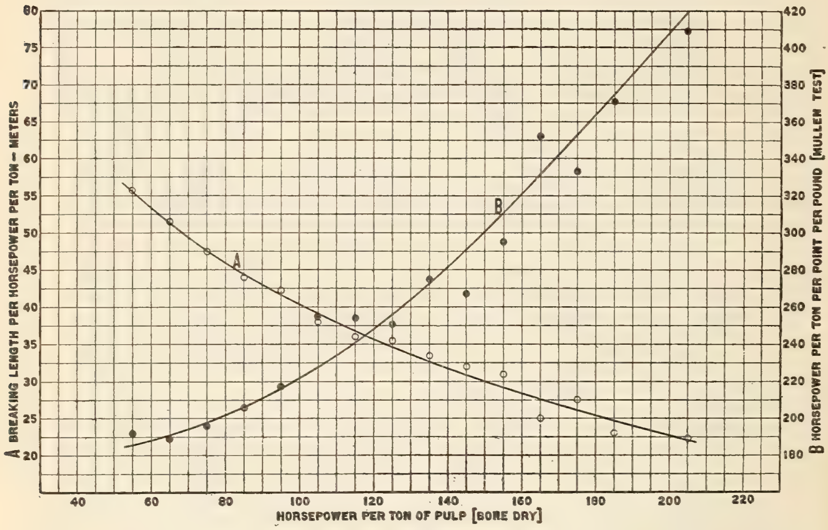


FIG. 22.—Relation of strength of paper per horsepower to power consumption per ton of pulp.

edly be costly on account of the handling necessary, the cost of steaming, and the loss in yield.

SUMMARY OF INFLUENCE OF GRINDING AND COOKING CONDITIONS IN THE PRODUCTION OF SPRUCE PULP.

The experiments conducted by the Forest Service, both in cooking spruce prior to grinding and in varying conditions of producing pulp, have led to the following conclusions:

COOKED WOOD.

(1) Cooking spruce prior to grinding results in a stronger fibered pulp, although at least 25 per cent more power per ton is required than is used in grinding untreated wood. The horsepower consumption per ton when grinding under conditions of varying cylinder pressure decreases to a minimum at approximately 65 pounds pressure on a 14-inch cylinder; this holds for dull or sharp stones.

(2) When wood is cooked under conditions of constant pressure and varying lengths of time the maximum power consumption per ton of pulp is obtained after cooking for six hours. This holds true regardless of the pressure at which the cooking takes place, between 0 and 75 pounds gauge pressure.

(3) Wood which is cooked at high pressure requires more power per ton of pulp when ground under the same conditions of cylinder pressure, speed, and surface of stone than wood which is cooked at lower pressure, if the duration of the cook is the same. Likewise, the production of pulp in 24 hours is materially less when the wood ground has been cooked at high pressure than if it had been cooked at low pressure.

(4) The yield per cord is influenced very greatly by the length of time the cooking is carried on and the pressure of the cook, being much lower for high pressures than for low and also for long cooking periods than for short.

(5) The power to the grinder increases with speed and pressure of grinding and decreases with the degree of sharpness of stone. There is also a very slight increase in the power required with increase of temperature, other conditions remaining constant, while the thickness of stock in the grinder pit has almost no influence. Under like conditions of all other factors the power to the grinder is less for steamed wood than for green or seasoned wood untreated.

(6) With a fixed amount of power to the grinder and a fixed grinding pressure, the speed of the pulp stone will vary greatly, depending on the length of time the wood has been steamed and the steaming pressure. Unsteamed wood will grind at low speed, while that steamed a long time will grind at high speed with the same amount of power to the grinder.

(7) There is little if any difference in the quality of pulp obtained as a result of using either the boiling or steaming process. The color, length of fiber, and yield are practically the same if the boiling or steaming is carried on at the same temperature.

(8) The amount of pulp produced in grinding cooked wood with a fixed amount of power to the grinder is less at high pressure and low speed than it is at low pressure and high speed. This results in a greater horsepower consumption per ton of pulp at high pressure and low speed.

UNCOOKED WOOD.

(1) The rate of production varies directly with pressure, speed, and degree of sharpness of stone. Less pulp is obtained in 24 hours using seasoned wood than with green, and still less using steamed wood, all other conditions being the same. The temperature influences the rate of production to some extent; less pulp is produced at low temperatures.

(2) The horsepower consumption per ton of pulp when untreated wood is ground increases as the pressure decreases according to a fairly definite law; it is lower on sharp stones than on dull ones, and increases as the speed decreases in much the same manner as it does with pressure. There is, however, not as much difference between the power consumption per ton at low speed and high speed as there is between power consumption at low pressure and high pressure. The power consumption is very little influenced by temperature, but it is slightly lower at high temperature. The power consumption is higher for seasoned wood than for green wood, and higher for steamed wood than for either seasoned or green material ground under the same conditions.

(3) The yield of pulp per cord is greater at high pressure than at low, and, while this is true also of the screenings, there is not as much fine material lost in white water when high pressure is used. The yield is not greatly influenced by the surface of the stone, but is slightly higher at high speed than at low. The yield is proportional to the bone-dry weight per cubic foot of wood.

(4) The quality of pulp varies greatly with the surface of the stone, less with the pressure, and least with the speed. The weight per cubic foot and character of wood influence quality to a marked extent, especially the latter; temperature also has a marked influence; pulp of greater strength is obtained at higher temperature; pulp produced at low temperature will take a better finish. Pulp of better color can be obtained from green wood than from seasoned, and stronger pulp can be obtained by cooking the wood prior to grinding. The quality of paper manufactured under exactly the same conditions, but made of pulp produced at different grinder pressures, varies greatly with the grinder pressure and the horsepower consumption per ton of pulp. Mechanical pulp of greatest strength can be produced only by the expenditure of a relatively large amount of power.

PART II.—SUBSTITUTES FOR SPRUCE IN THE MANUFACTURE OF GROUND-WOOD PULP.

EXPERIMENTAL AND COMMERCIAL TESTS ON VARIOUS WOODS.

Grinding tests of 22 different woods were made at the Wausau laboratory. Samples of the experimental pulps were sent to the Madison laboratory for tests to determine their quality. The experimental apparatus and the methods of operation were the same as those used in the case of spruce and described in Forest Service Bulletin 127.

In addition to the experimental tests, "commercial" tests were made of the production of pulp and of the manufacture of paper. The methods employed in the preparation of the wood and the production of pulp were identical with those in the qualitative and quantitative

tests, except that more wood was employed and more pulp produced. As a rule, 2.5 tons of bone-dry pulp were manufactured during each test, though in some cases 5 tons were made. Data were recorded on power consumption, rate of production, yield, etc., and as soon as practicable the pulp was shipped to mills in the vicinity of Wausau to be made into paper. The aim in making the paper was to produce as good a grade of news print as possible from the experimental pulps under the standard mill practice of the company to which the pulps were sent. The one divergence from this practice was in the treatment of the pulp in the beater, as in some cases different amounts and kinds of color had to be added to secure the best results. The amount of size, alum, loading, color, etc., was recorded for each beater of pulp, as also were the amounts of sulphite and ground wood used. The size of screen slots, speed of machine, width of wire, etc., were also recorded.

The paper produced from the experimental pulps was given a practical try out on the presses of the New York Herald and the St. Louis Republic. The tests were conducted under the ordinary operating conditions of the pressrooms of the two newspapers. The color of the different papers varied considerably, but this was not assumed to detract from their value for news-print purposes within certain limits. Record was made of the amount of waste, the number and causes of breaks, and the number of papers run from a given quantity of material. Observations were also made on the general operating conditions and the appearance of the sheet when printed. Judgment of these latter factors was left very largely to the practical pressmen.

KINDS OF WOOD TESTED.

The woods tested to determine their suitability for mechanical pulp were as follows:

Balsam fir (*Abies balsamea*).
Red fir (*Abies magnifica*).
White fir (*Abies concolor*).
Alpine fir (*Abies lasiocarpa*).
Amabilis fir (*Abies amabilis*).
Lowland fir (*Abies grandis*).
Noble fir (*Abies nobilis*).
Eastern hemlock (*Tsuga canadensis*).
Western hemlock (*Tsuga heterophylla*).
Tamarack (*Larix laricina*).
Western larch (*Larix occidentalis*).
Lodgepole pine, Montana (*Pinus murrayana*).
Lodgepole pine, California (*Pinus murrayana*).
Western yellow pine (*Pinus ponderosa*).
Jack pine (*Pinus divaricata*).
Loblolly pine (*Pinus tæda*).
White pine (*Pinus strobus*).
Engelmann spruce, Montana (*Picea engelmanni*).
Engelmann spruce, Colorado (*Picea engelmanni*).
Sitka spruce (*Picea sitchensis*).
White spruce (*Picea canadensis*).
White birch (*Betula papyrifera*).
Aspen [1] (*Populus tremuloides*).
Black gum (*Nyssa sylvatica*).

[1] Called "popple" in Wisconsin.

TABLE 1.—*Amounts of different species used and where cut.*

Kind of wood.	Shipment No.	Amount used.	State where grown.	County where grown.	Remarks.
		Cords.			
Tamarack (*Larix laricina*)	1	15	Wis.	Lincoln	Swampy land, close stand.
Do	2	15	do	do	Do.
Jack pine (*Pinus divaricata*)	3	15	do	do	Side hill, sloping south and east, sandy soil, close stand.
Do	4	15	do	do	Swampy land, close stand.
Do	5	15	do	do	Side hill, sloping south and east, sandy soil, close stand.
White spruce (*Picea canadensis*).	6	8	do	do	No further description.
Hemlock (*Tsuga canadensis*)	6	8	do	do	Do.
Jack pine (*Pinus divaricata*)	7	15	do	do	Side hill, sloping south and east, sandy soil, close stand.
Do	8	10	do	do	Stock of Grand Rapids Paper Co.
Hemlock (*Tsuga canadensis*)	9	10	Mich.		
Balsam fir (*Abies balsamea*)	9	2	do		
White spruce (*Picea canadensis*).	9	4	do		
Do	10	20	Wis.		Stock of Marathon Paper Mills Co.
Hemlock (*Tsuga canadensis*)	11	16	do		Do.
Do	12	18	do		Stock of Nekoosa-Edwards Paper Co.
Lodgepole pine (*Pinus murrayana*).	13	15	Mont.	Deerlodge	Slope south, 7,000 feet elevation, clay soil.
Western yellow pine (*Pinus ponderosa*).	14	16	do	Missoula	Elevation 3,500 feet, glacial loam soil.
Red fir (*Abies magnifica*)	15	8	Cal.	Nevada	Stock of Floriston Pulp & Paper Co.
Lodgepole pine (*Pinus murrayana*).	16	7	do	do	Do.
Western larch (*Larix occidentalis*).	16	12	Mont.	Lincoln	Elevation 3,100 feet, heavy forest, dry, deep clay soil.
White spruce (*Picea canadensis*).	17	8	Wis.	Price	Stock of Nekoosa-Edwards Paper Co.
Balsam fir (*Abies balsamea*)	17	8	do	do	Do.
White spruce (*Picea canadensis*).	18	18	do	do	Do.
Aspen (*Populus tremuloides*)	19	8	do	do	No other data available.
White birch (*Betula papyrifera*).	19	11	do	do	Do.
White spruce (*Picea canadensis*).	20	16	do	do	Stock of Nekoosa-Edwards Paper Co.
Western hemlock (*Tsuga heterophylla*).	21	8	Wash	Chehalis	Aberdeen Chamber of Commerce.
Sitka spruce (*Picea sitchensis*).	21	8	do	do	Do.
White spruce (*Picea canadensis*).	22	18	Wis.	Price	Stock of Nekoosa-Edwards Paper Co.
Lodgepole pine (*Pinus murrayana*).	23	9	Cal.		Stock of Floriston Pulp & Paper Co.
Red fir (*Abies magnifica*)	23	9	do		Do.
White spruce (*Picea canadensis*).	24	15	Wis.	Price	Stock of Nekoosa-Edwards Paper Co.
Balsam fir (*Abies balsamea*)	25	8	do	do	Do.
White pine (*Pinus strobus*)	25	8	do	do	Do.
Engelmann spruce (*Picea engelmanni*).	26	6	Colo.	(Cochetopa Nat. For.)	Elevation 9,200 feet, deep black soil.
White fir (*Abies concolor*)	27	17	Cal.	Plumas	Elevation 3,220 feet, red clay and shale soil.
Amabilis fir (*Abies amabilis*)	28	8	Wash.	Whitcom	Elevation 2,150, fragmentary rock soil.
Lowland fir (*Abies grandis*)	29	5½	Mont.	Missoula	Elevation 3,400 feet, sandy loam.
Alpine fir (*Abies lasiocarpa*)	29	6	do	do	Elevation 3,300 feet, sandy loam.
Engelmann spruce (*Picea engelmanni*).	29	5	do	do	Elevation 3,300 feet, gravelly loam.
White spruce (*Picea canadensis*).	30	10			Stock of Nekoosa-Edwards Paper Co.
Loblolly pine (*Pinus tæda*)	31	6	N. C.		Stock of Beaver Co., Weldon, N. C.
Black gum (*Nyssa sylvatica*)	32	5	La.	Winn	Hardwood bottoms.
Tamarack (partially decayed).	33	½			Selected from culls of stock of Marathon Paper Mills Co.
Noble fir (*Abies nobilis*)	34	6	Oreg.	Multnomah	Elevation 3,500 feet, rocky soil.

The region in which the different species grow is shown on the maps, figures 23 to 44. Table 1 gives source of shipments tested. Information concerning the amount of each kind of timber available

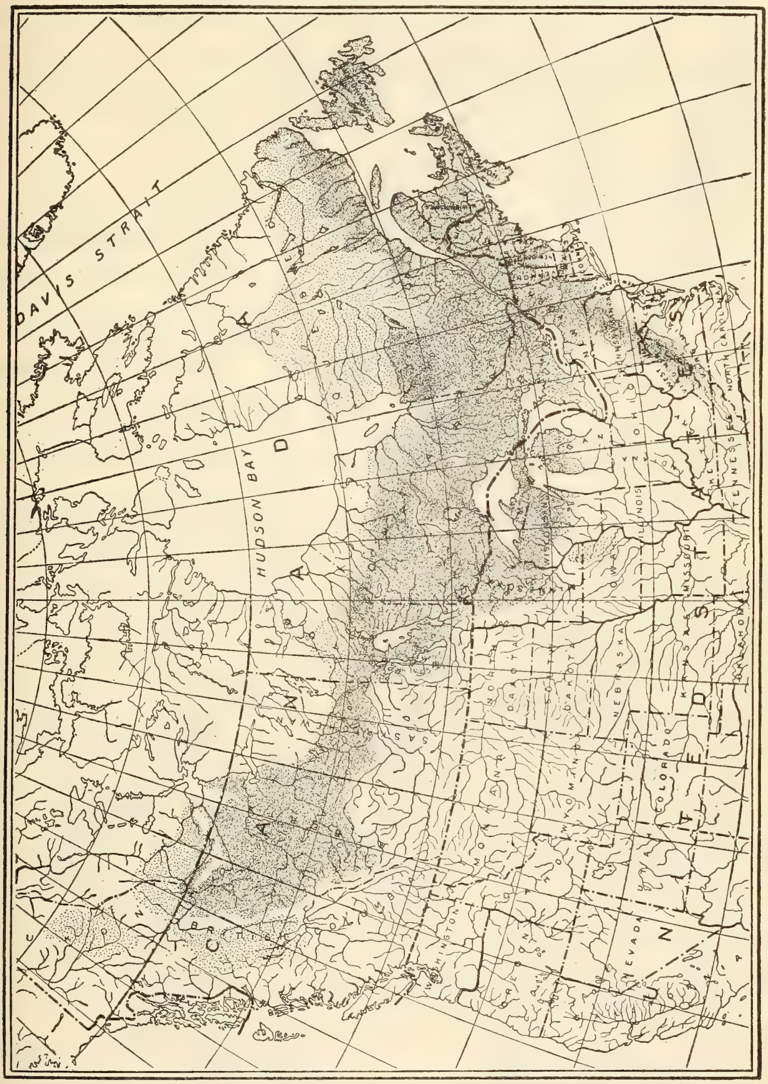


Fig. 23.—Balsam fir (*Abies balsamea*).

and other facts relating to the stand and supply will be furnished by the Forest Service upon request.

RESULTS OF GRINDING TESTS.

On the whole, very little difficulty was encountered in producing pulp from the woods tested. With the conifers, at least, grinding could be done under practically the same conditions employed for

spruce. All the substitutes, however, with the possible exception of noble fir and amabilis fir, required the use of more power per ton of pulp. Also, while a good grade of spruce pulp can be produced under widely varying conditions of grinding, the best results were generally obtained from the other woods when the stone was somewhat dull, the pressure high, and the speed of grinding rather slow.

FIG. 24.—Red fir (*Abies magnifica*).

THE FIRS.

The firs tested were balsam fir (*Abies balsamea*), red fir (*Abies magnifica*), white fir (*Abies concolor*), amabilis fir (*Abies amabilis*), alpine fir (*Abies lasiocarpa*), lowland or grand fir (*Abies grandis*), and noble fir (*Abies nobilis*).

A good sheet of pulp can easily be obtained from balsam fir if the wood is in a green state. Such pulp is as light in color as, if not lighter than, spruce, and a fairly sharp stone can be used in grinding it. Seasoned wood, however, usually shows decay and insect attack, and it is practically impossible to grind it into pulp which will not contain many shives and be somewhat soft. The yield from balsam fir is about 1,910 pounds (bone-dry pulp) per hundred cubic feet of solid rossed wood, or approximately 490 pounds less than the yield from an equal quantity of white spruce.

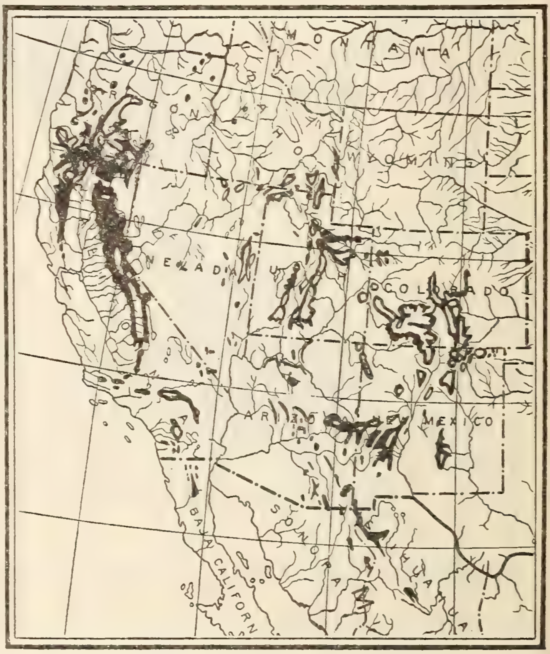


FIG. 25.—White fir (*Abies concolor*).

Red fir, like balsam, is easily ground to a pulp satisfactory for news-print purposes. It required, however, more power per ton of pulp, due possibly to the fact that the wood used in the experiments was of such a large diameter that it had to

be split before it could be ground. The pulp had a reddish tinge, which made it less suitable for news-print purposes than that of some other woods which grow in the same region. The yield was approximately 1,915 pounds (bone dry) per hundred cubic feet of solid rossed wood, or nearly 500 pounds less than for white spruce. On the basis of a cord of rough wood the difference in yield would be even greater on account of red fir's extremely thick bark.

White fir yields a very satisfactory pulp, especially when the wood is green and comes from young trees. Tests conducted on this species, to note the influence of age of the trees on the quality of the pulp produced, showed that pulp from the split wood of trees 40 inches in diameter and 130 feet high was inferior in color, fiber, and yield to pulp obtained from trees of 18 inches in diameter or less. Pulp obtained from the older wood was inclined to be soft and shivy; that from the younger wood did not show these defects. The color of white-fir pulp is better than that of red fir, though not as good as that of balsam. White-fir pulp is rather soft. The yield is approximately 2,000 pounds (bone dry) per hundred cubic feet of solid rossed wood, or about 400 pounds less than white spruce.

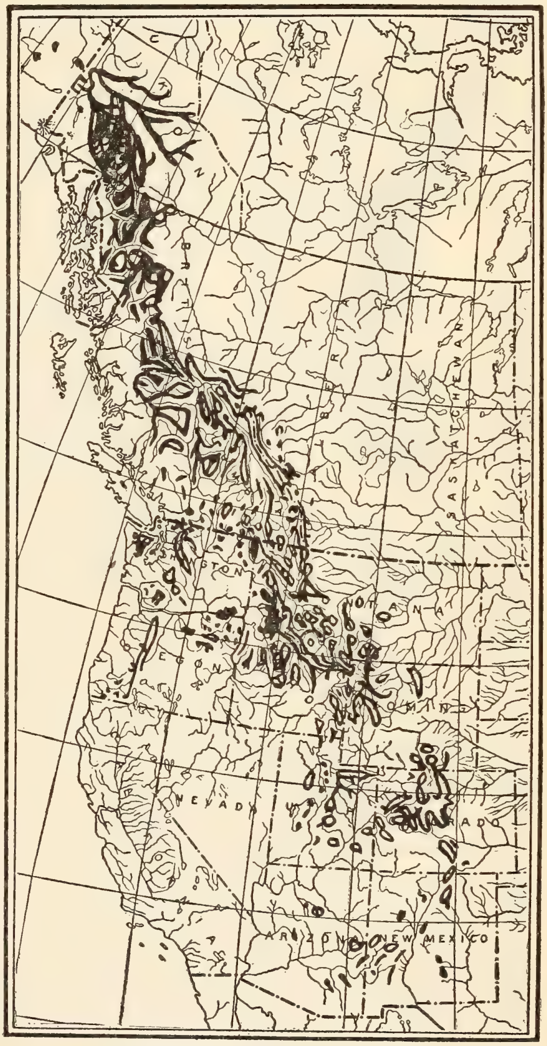


FIG. 26.—Alpine fir (*Abies lasiocarpa*).

Alpine fir yields a very good quality of pulp, which in color is as light as, if not lighter than, spruce pulp. It can be ground with a

fairly sharp stone and without an unusual expenditure of power. The result is a pulp very satisfactory for news-print purposes. The yield is approximately 2,060 pounds (bone dry) per hundred cubic feet of solid rossed wood. This wood is usually free from knots and other irregularities, and has a fairly thin, smooth bark.

Fig. 27.—Amabilis fir (*Abies amabilis*).

Amabilis fir readily grinds to a pulp suitable for news-print purposes. The color of the pulp is slightly grayish, but an excellent fiber can be produced with a sharp stone and a reasonable amount of power. In strength the pulp is about equal to that obtained from spruce. The wood used in the tests was split from large logs having a number of good-sized knots. The yield is approximately 1,870 pounds (bone dry) per hundred cubic feet of solid rossed wood. As in the case of red fir, the thick bark of amabilis fir would result in decreasing the yield were the latter figured on the basis of a rough-piled cord.

Lowland or grand fir can be ground on a fairly sharp stone to produce pulp well adapted for news-print paper. The quality is not up to that of balsam or amabilis fir, but is better than that of white, alpine, or red fir. The pulp produced at the laboratory had a slightly grayish cast, which in some measure might be due to the heart rot that was beginning to attack many of the logs. The yield was approximately 1,950 pounds (bone dry) per hundred cubic feet of solid rossed wood.

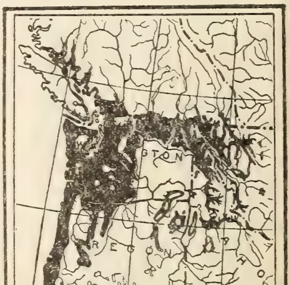


Fig. 28.—Lowland fir (*Abies grandis*).

Noble fir readily yields a pulp satisfactory for news-print purposes. Like white spruce, it can be ground with a wide variation of power consumption. The pulp has a marked pinkish tinge, which is objectionable, but the fibers are of unusual length and strength, though with a tendency to coarseness. The wood tested was supplied from a large tree freshly cut and was remarkably free from knots. The yield was approximately 1,920 pounds (bone dry) per hundred cubic feet of solid rossed wood, or about 480 pounds less than that from an equal amount of spruce.

THE HEMLOCKS.

Eastern hemlock (*Tsuga canadensis*) requires a considerable amount of power for the production of satisfactory pulp. The wood must also be of fairly small diameter and of very good quality. Even under the best conditions, eastern hemlock pulp does not present a good appearance; the fibers are short, and it has a decided reddish tinge. Moreover, it is very hard to produce pulp which will not crack along the edges when the laps are folded. However, even with the handicap of short fibers, a pulp satisfactory for news-print purposes can be produced. The yield from eastern hemlock is approximately 2,030 pounds per hundred cubic feet of solid rossed wood (370 pounds less than from an equal amount of white spruce), though the same ratio would not be evident if the basis were a cord of rough wood.

Western hemlock (*Tsuga heterophylla*) can be ground at much higher pressures and with a sharper stone than eastern hemlock. The pulp produced is of very good quality and aside from its grayish color compares well with white spruce. It is far superior to that from eastern hemlock. The yield is about 2,160 pounds per hundred cubic feet of solid rossed wood, or 240 pounds less than that from white spruce, though the bark of western hemlock is much heavier than that of the latter species.

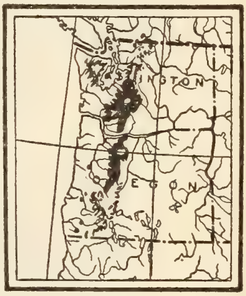


FIG. 29.—Noble fir (*Abies nobilis*).

THE LARCHES.

Tamarack (*Larix laricina*) produces a very good quality of pulp with a reasonable amount of power. In color, however, the pulp is a decidedly grayish green. It would probably serve for news-print paper if used with spruce sulphite or mixed with spruce ground wood. In any event, it could be used for wrapping paper. The yield is approximately 2,620 pounds per hundred cubic feet of solid rossed wood, or about 220 pounds more than from an equal amount of white spruce.

Western larch (*Larix occidentalis*) yields a very inferior pulp. The product is difficult to operate on the wet machine, and the pulp stone must be rough, but not sharp, to secure the best results. In other words, the pulp must have coarse fibers and a relatively large number of shives. The color, a decided brown, is objectionable. The yield from western larch was only 2,100 pounds per hundred cubic feet of solid rossed wood, though on the basis of the dry weight of the wood it should have been at least 2,300 pounds. This difference is probably due to the high proportion of the wood substance that is soluble in water and to the brittleness of the heartwood, so that a large percentage of the yield is lost in the white water.

THE PINES.

Both the California and Montana lodgepole pine (*Pinus murrayana*) yield pulp of very good quality. The wood can be ground under ordinary conditions and does not require the consumption of a large amount of power. Satisfactory results are obtained when the wood is ground at high pressures and at high speed, provided the stone is somewhat dull. The color of the pulp from both varieties compares favorably with that of white spruce, though the Montana wood is somewhat lighter than the California. The resin did not prove objectionable. Montana lodgepole pine yielded

FIG. 30.—Eastern hemlock (*Tsuga canadensis*).

approximately 2,140 pounds of pulp (bone dry) per hundred cubic feet of rossed wood, while California trees yielded about 1,920 pounds. The difference was due to the greater age, larger size, and lighter weight of the California wood.

Western yellow pine (*Pinus ponderosa*) can be ground under a wide variety of conditions. The pulp has a fairly long, coarse fiber and is invariably soft. In color it tends toward a creamy, resembling to some extent that obtained from jack pine. While the wood used in the test contained considerable pitch, this did not cause much trouble either in the grinding process or in the operation of the wet machine. The wood used was cut in October, and it is reasonable to suppose that material cut after the sap had gone down would

have been better. The fact that the majority of the tests were made after the wood had seasoned from one to one and one-half years might also account for the more satisfactory operation of the material. The yield was approximately 2,060 pounds per hundred cubic feet of solid rossed wood.

FIG 31.—Western hemlock (*Tsuga heterophylla*).

Jack pine (*Pinus divaricata*) yields a very good pulp when ground with a rather dull stone, necessitating, of course, a high power consumption. The pulp produced at a consumption of from 90 to 100 horsepower per ton for 24 hours compares favorably with white spruce pulp made with a somewhat lower power consumption. In

color jack pine is creamish or even brownish, and the pitch may cause trouble on the felts, especially if the wood is not seasoned or has not been ponded for a considerable period of time. The best results can be obtained from pitchy woods if the trees are cut when the sap is down. The yield of jack-pine pulp per hundred cubic feet of solid rossed wood was about 200 pounds less than that from an equal amount of white spruce.

Loblolly pine (*Pinus tæda*) requires a dull stone and consequently an expenditure of a large amount of power, but does not yield a pulp of as good a quality as may be obtained from the other pines

FIG. 32.—Tamarack (*Larix laricina*).

tested. Although hardly suitable for news-print purposes, loblolly-pine pulp could no doubt be used as a filler. Tests were made on wood cut in the spring and allowed to remain in the forest until the bark became loosened and on wood cut in the fall and split for fire-wood. The fall-cut wood produced a creamy colored pulp, while the spring-cut wood gave one of a brownish shade. Practically no other difference was noted in the quality. The yield from the fall-cut wood was about 2,500 pounds per hundred cubic feet of rossed wood, while that from the spring-cut wood was 2,400 pounds, the amount in each case being proportional to the weight per cubic foot of the wood.

Through a mistake in shipment a quantity of white pine (*Pinus strobus*) was received at the laboratory. It had not been the intention to test this wood, since its value for lumber eliminates it from consideration as a possible substitute for spruce. Tests were made on it, however, since it was at hand. It can be ground on a fairly sharp stone to yield fibers of good strength and excellent color. The pulp contains a considerable amount of pitch, and, like that from the other pines, is inclined to be soft. The yield was approximately 1,885 pounds per hundred cubic feet of solid rossed wood.

THE SPRUCES.

Engelmann spruce (*Picea engelmanni*) can be ground under the same conditions used for white spruce. The pulp has an excellent color and a long strong fiber. The fact that the wood ground at the laboratory was in a green state undoubtedly made it easier to produce a good grade of pulp. Wood obtained from Colorado in the form of small logs showed no difference in quality from similar material obtained from Montana, though the latter, owing to its greater weight per cubic foot, yielded about 2,250 pounds of pulp (bone dry) per hundred cubic feet of rossed wood against 2,000 pounds for the Colorado material.

FIG. 33.—Western larch (*Larix occidentalis*).

Sitka spruce (*Picea sitchensis*) yields a pulp of very good quality, though not equal to that from white spruce. Although the wood can be ground under practically any condition of speed, sharpness of stone, and grinder pressure, the fibers are not as fine and long as those of the white spruce. In color, moreover, Sitka spruce pulp is inclined to be grayish. The wood tested was cut during the latter part of April and contained considerable pitch. It undoubtedly would have run better had it been cut earlier in the year. The yield was 2,100 pounds per hundred cubic feet of solid rossed wood, or about 200 pounds less than that from an equal amount of white spruce.

THE HARDWOODS.

Aspen (*Populus tremuloides*) requires the consumption of a large amount of power to produce pulp which will run satisfactorily on the wet machine. If the pulp stone is too sharp or a less amount of power is used, the pulp will be very short. When mixed with spruce, however, it operates very satisfactorily. Aspen pulp possesses good

color, although it is likely to contain black specks of bark unless knots are removed from the wood before it is ground. The yield was approximately 2,200 pounds per hundred cubic feet of solid rossed wood.

FIG. 34.—Lodgepole pine (*Pinus contorta*).

White birch (*Betula papyrifera*) yields a pulp in which the fibers are short, though very fine. It is necessary to use a very dull stone in the grinding process, and even then laps crack along the edges when folded. The pulp, moreover, has a decidedly pinkish tinge, but the ground wood could undoubtedly be used as a filler in the produc-

tion of certain grades of paper. The yield per hundred cubic feet is very high, approximately 2,950 pounds, or 550 pounds more than that from an equal amount of spruce. On the basis of a rough cord, however, this difference would be materially reduced, since white birch logs have a thick bark and are often crooked.

Black gum (*Nyssa sylvatica*) yields a fiber that in many ways resembles that obtained from white birch. It is extremely short, but forms a tougher sheet than coniferous fibers of the same length. Considerable power must be expended to produce laps that can be

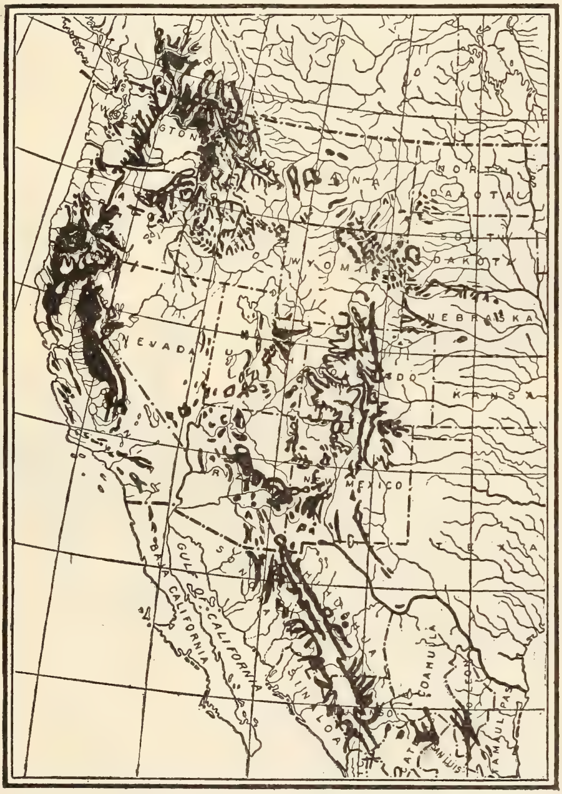


FIG. 35.—Western yellow pine (*Pinus ponderosa*).

taken off the wet machine satisfactorily. The pulp is not promising from a news-print standpoint, but could be used as a filler or mixed with pulp of a better grade. In color it is very white, ranking high in this respect among the woods tested. Steaming the wood prior to grinding gives a stronger pulp, but not to the extent observed in the case of birch similarly treated. The yield of pulp from black gum is approximately 2,600 pounds per hundred cubic feet of solid rossed wood.

WOODS STEAMED PREVIOUS TO GRINDING.

In addition to the tests on untreated wood, other tests were made on steamed material. Practically all of the conifers yielded fairly strong, brownish-colored pulps suitable for the production of board and cheap grades of brown wrapping paper. Balsam fir, noble fir, amabilis fir, Alpine fir, and white and Engelmann spruce pulps showed longer fibers and felted somewhat better than those from the other woods. When steamed all of the conifers required the consumption of a relatively large amount of power for the production of satisfactory pulps. This was not the case, however, with aspen and

FIG. 36.—Jack pine (*Pinus divaricata*).

white birch, which produce much stronger pulps when treated before grinding, the product comparing favorably in color and toughness with spruce pulp. The fibers of the aspen and white birch were shorter, it is true, than those of spruce, but the felting qualities of the hardwood pulps are better than those of spruce pulp. Steamed aspen and white birch can be ground with a comparatively small amount of power to produce the kind of pulp just described.

A heavy loss in wood substance was noted in the case of all the species tested except western larch. The fibers of the latter wood seem to become tougher as the result of cooking and do not grind up to a fine powder which passes through the meshes of the cylinder mold.

F—LAB. 10

FIG. 1.—UNSTEAMED (RUN NO. 2).

F—LAB. 11

FIG. 2.—STEAMED (RUN NO. 3).

WHITE BIRCH MECHANICAL PULP.

F-LAB. 12

FIG. 1.—STEAMED (RUN NO. 5).

F-LAB. 13

FIG. 2.—UNSTEAMED (RUN NO. 2).

ASPEN MECHANICAL PULP.

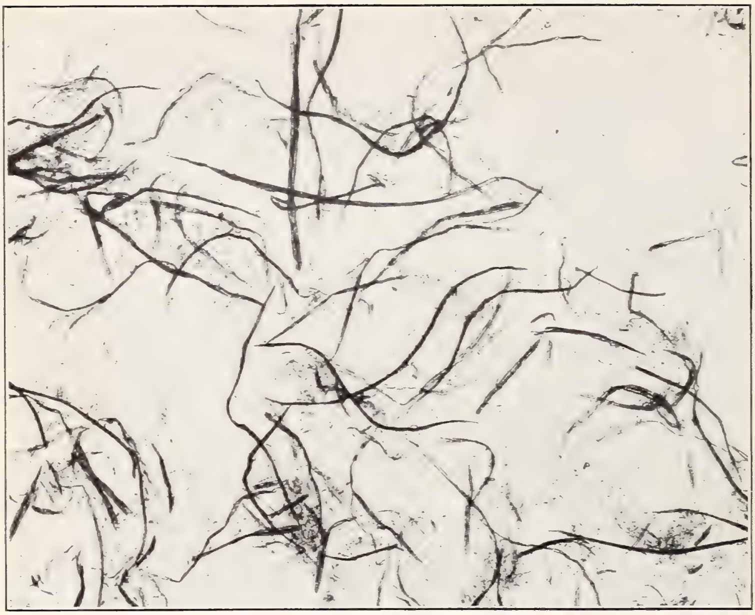
F—LAB. 14

FIG. 1.—UNSTEAMED (RUN NO. 56).

F—LAB. 15

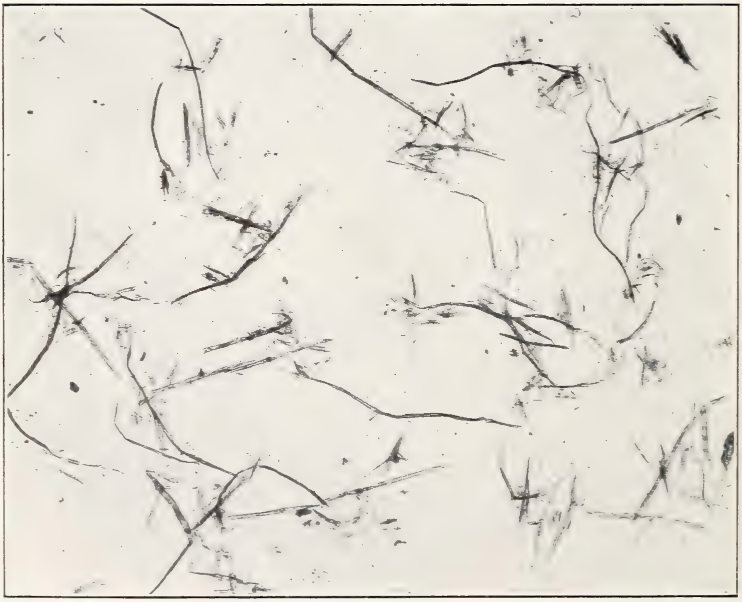
FIG. 2.—STEAMED (RUN NO. 62).

HEMLOCK MECHANICAL PULP.



F-LAB. 16

FIG. 1.—STEAMED (RUN NO. 30).



F-LAB. 17

FIG. 2.—UNSTEAMED (RUN NO. 27).

JACK PINE MECHANICAL PULP.


F-LAB. 18

FIG. 1.—STEAMED (RUN NO. 25).

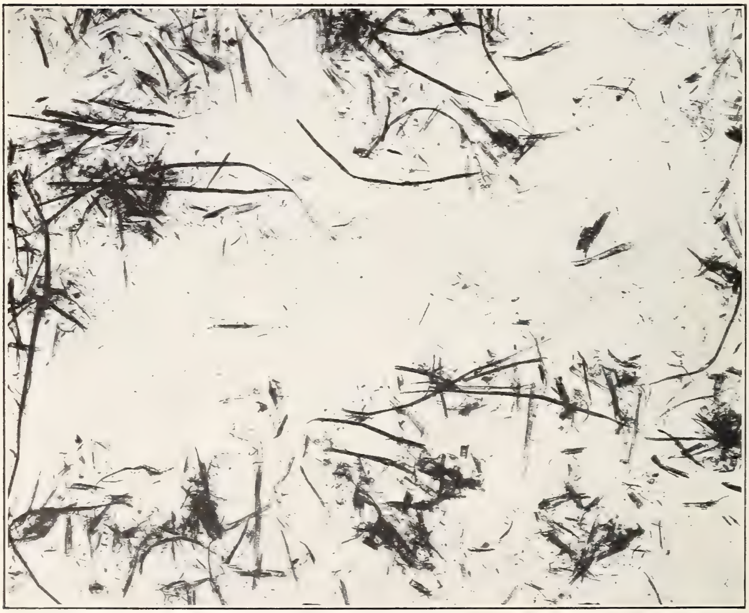

F-LAB. 19

FIG. 2.—UNSTEAMED (RUN NO. 26).

TAMARACK MECHANICAL PULP.

F-LAB. 20

FIG. 1.—RED FIR MECHANICAL PULP UNSTEAMED (RUN NO. 4).



F-LAB. 21

FIG. 2.—WESTERN LARCH MECHANICAL PULP UNSTEAMED (RUN NO. 2).

F—LAB. 22

FIG. 1.—WESTERN HEMLOCK MECHANICAL PULP UNSTEAMED (RUN NO. 1).

F—LAB. 23

FIG. 2.—LODGEPOLE PINE (CALIFORNIA) MECHANICAL PULP UNSTEAMED (RUN NO. 2).

FIG. 1.—WESTERN LARCH MECHANICAL PULP STEAMED (RUN NO. 1).

FIG. 2.—LODGEPOLE PINE (CALIFORNIA) MECHANICAL PULP STEAMED (RUN NO. 1).

F—LAB. 26

FIG. 1.—BALSAM FIR MECHANICAL PULP UNSTEAMED (RUN NO. 14).

F—LAB. 27

FIG. 2.—NOBLE FIR MECHANICAL PULP UNSTEAMED (RUN NO. 2).

MICROSCOPIC COMPARISON OF GROUND-WOOD FIBERS.

Plates IV to XII are photomicrographs of the ground-wood fibers obtained from the various species tested. It is not possible, of course, to gauge accurately from such photographs the pulp-making qualities of the fibers. Length of fiber does not necessarily mean strength, for a stronger pulp can be obtained from fibers which, though quite short, will felt well. Steamed white birch pulp, for example, will test as high in strength as longer-fibered material from the pines, larches, and hemlocks. However, the photographs make it possible to compare the characteristics of the fibers of one kind of wood with those of another kind, especially since the lodgepole pine,

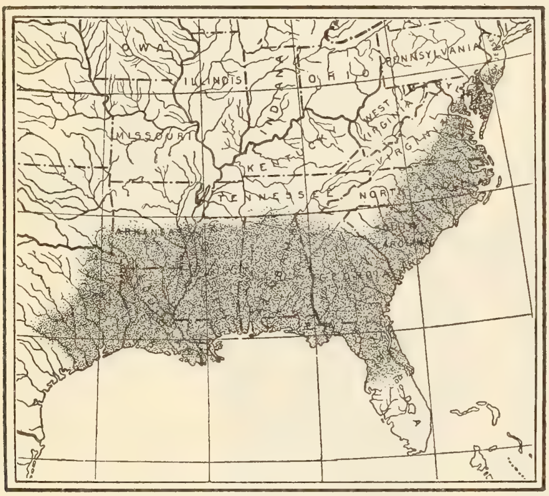


FIG. 37.—Loblolly pine (*Pinus tæda*).

western hemlock, western larch, red fir, balsam, white birch, jack pine, hemlock, and tamarack were ground under the same conditions of pressure, speed, surface of stone, etc. For some of these species photographs of both cooked and uncooked fibers are shown. The cooked-wood specimens were not treated in the same manner, nor were they ground under like conditions.

In the case of birch (Pl. IV) it will be seen that the uncooked pulp is very short and contains much wood flour, while the cooked fibers are fairly long and very fine. When run into paper without the addition of sulphite the steamed pulp showed a strength under test of 0.51 point per pound and 5.8 points per thousandth inch of thickness.

The aspen fibers (shown in Pl. V) appear to be even shorter than those of the birch. The steamed pulp when run into a 63-pound sheet gave a Mullen test of 0.51 point per pound and 6.2 points per thousandth inch of thickness.

Between the cooked and uncooked hemlock fibers (shown in Pl. VI) there is more contrast in respect to length than in the case of birch and poplar. The cooked hemlock when run into a 55-pound sheet without sulphite gave a Mullen test of 0.51 point per pound and 6 points per thousandth inch of thickness.

Both the steamed and unsteamed jack pine (shown in Pl. VII) are remarkably free from wood flour and short fiber. The steamed-

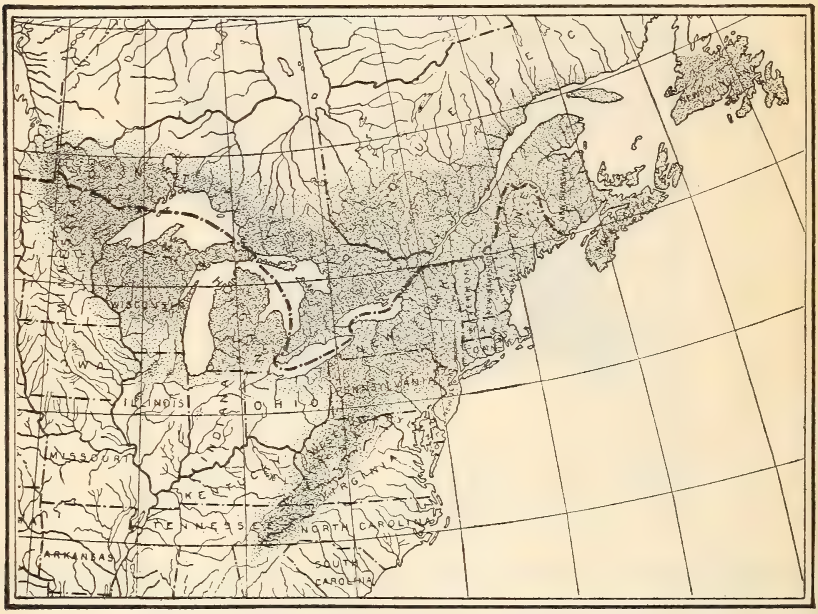


FIG. 38.—White pine (*Pinus strobus*).

wood sample, when run into a 43-pound sheet without sulphite, gave a Mullen test of 0.47 point per pound and 4.5 points per thousandth inch of thickness.

In Plate VIII, which shows steamed and unsteamed tamarack fibers, the much greater length of the former is apparent.

Plates IV, VI to X, and XII, figure 1, show the fibers from a number of different woods ground in the natural state under the same conditions. With the exception of western larch, the fibers are of very good quality and compare well with those of spruce. So far as length and fineness go, the fibers shown in Plates VII, X, and XII are fully equal to spruce.

EXPERIMENTAL MANUFACTURE OF PAPER.

A limited amount of paper (waterleaf) was made experimentally at the Madison laboratory from the various pulps and tested for strength and color. In every case the conditions of manufacture were identical, and no coloring matter was added to any of the pulps in the beater. The paper machine used was too small to permit of

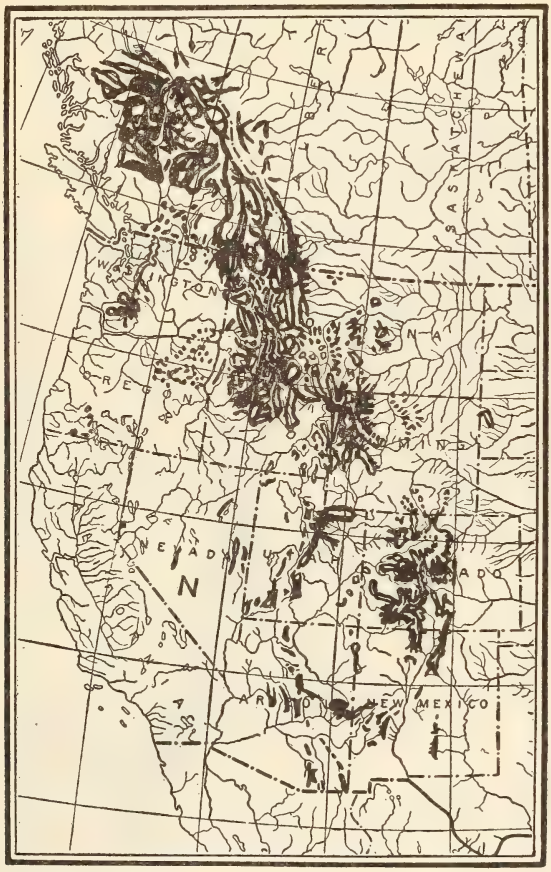


FIG. 39.—Engelmann spruce (*Picea engelmanni*).

reliable data being obtained upon such points as operation of the pulp on the machine, calendering, and the like.

In the matter of color the various wood fibers (unsteamed) may be arranged in the order given below, the basis being the number of parts of black which each sample contained, that with the smallest number ranking first. It should be remembered that the arrangement is made as the result of tests on many different samples of paper from the same wood, rather than on the particular samples

which accompany this bulletin, and also that the different woods were in various stages of seasoning when ground into pulp, a fact which might materially influence their relative color rating:

1. Alpine fir.
2. White spruce.
3. Engelmann spruce.
4. Black gum.
5. Lowland fir.
6. Montana lodgepole pine.
7. Loblolly pine (fall cut).
8. White pine.
9. Balsam fir.
10. White fir (young wood).
11. Western yellow pine.
12. California lodgepole pine.
13. Amabilis fir.
14. Jack pine.
15. White fir (old and young trees mixed).
16. Noble fir.
17. Loblolly pine (spring cut).
18. Aspen.
19. White birch.
20. Sitka spruce.
21. Eastern hemlock.
22. Red fir.
23. Tamarack.
24. Western hemlock.
25. Larch.

FIG. 40.—Sitka spruce (*Picea sitchensis*).

White, Alpine, amabilis, and balsam fir are light in color, comparing very favorably in this respect with white spruce. Red fir and noble

fir, however, have a pinkish tinge, as has eastern hemlock and white birch. Western hemlock is grayish. Lodgepole pine has a good color, but western yellow pine is a yellowish white, and jack pine and loblolly have a brownish tinge. Both western larch and eastern larch

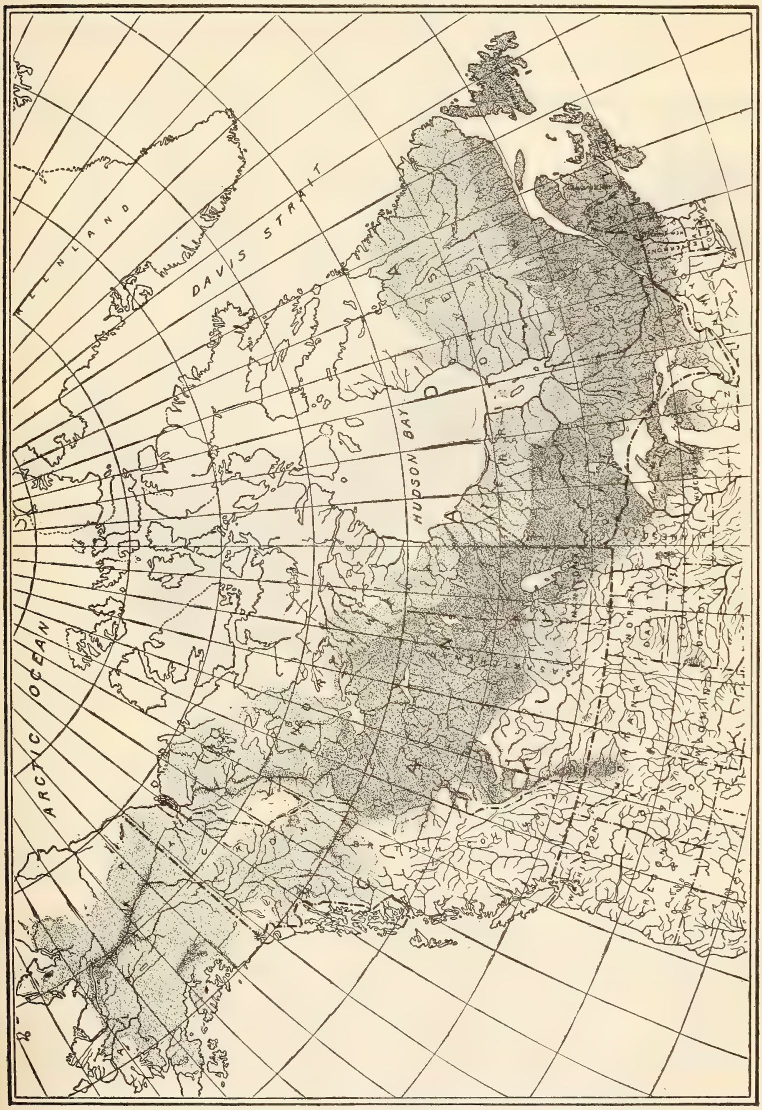


Fig. 41.—White spruce (*Picea canadensis*).

(tamarack) are of poor color for news-print purposes, the former being very brown and the latter dark gray. Aspen and black gum have a good color. Sitka spruce is gray, but Engelmann spruce is fully as bright as white spruce.

It is very difficult to obtain reliable data on the relative strength of pulps from different woods, owing to the fact that it is almost impossible to produce them under identical conditions of grinding, especially as regards power consumption per ton, a factor which largely influences their strength. The result of strength tests made at the laboratory on the experimental pulps seems to indicate, however, that but one of them surpasses white spruce pulp. This refers,

FIG. 42.—Aspen (*Populus tremuloides*).

of course, to the uncooked pulps. Tests made on the steamed pulps indicate that those from the hardwoods produced with a smaller consumption of power surpass white spruce in bursting strength. If the results of tests on the breaking length in meters per horsepower per ton and those of the horsepower per ton per point per pound are averaged for power consumptions of from 80 to 100 horsepower, the experimental woods can be arranged in the following order as regards their strength, the strongest coming first:

1. Noble fir.
2. White spruce.
3. Amabilis fir.
4. Engelmann spruce.
5. Western hemlock.
6. Sitka spruce.
7. Balsam fir.
8. Lowland fir.
9. Red fir.
10. Montana lodgepole pine.
11. White fir.
12. Alpine fir.
13. California lodgepole pine.
14. White pine.
15. Western yellow pine.
16. Tamarack.
17. Jack pine.
18. Loblolly pine.
19. Hemlock.
20. Larch.
21. Aspen.
22. Black gum.
23. Birch.

COMMERCIAL MANUFACTURE OF PAPER.

To secure reliable data on the operation of the pulps on the paper machine approximately 5,000 pounds of bone-dry pulp were manufactured from each kind of wood. At the start 5 tons of pulp were made, but it was found later that the smaller amount would be sufficient for the purpose of the test. The papers were made at the mills of the Rhinelander Paper Co., Rhinelander, Wis., and the Nekoosa-Edwards Paper Co., Port Edwards, Wis. The woods and mixtures of woods used were as follows:

- Jack pine, green.
- Jack pine, seasoned.
- Hemlock.
- One-third spruce, two-thirds hemlock.
- One-third spruce, one-third hemlock, and one-third jack pine.
- Two-thirds hemlock, one-third jack pine.

1. Spruce.
2. Western hemlock.
3. Sitka spruce.
4. Montana lodgepole pine.
5. Western yellow pine.
6. Balsam fir.
7. California lodgepole pine.
8. Red fir.
9. One-half spruce and one-half hemlock.
10. One-half balsam fir and one-half spruce.
11. Tamarack.
12. One-half tamarack and one-half spruce.
13. Noble fir.
14. Alpine fir.
15. White spruce.
16. Engelmann spruce (Colorado).
17. Amabilis fir.

As the former group of tests has been previously reported upon (Forest Service Bulletin, "Experiments with Jack Pine and Hemlock for Mechanical Pulp"), only the last 17 papers manufactured at the Nekoosa-Edwards Paper Co. will be considered.

Table 57 gives the results of the commercial runs. Samples of the printed and unprinted sheets accompany this bulletin.

For the first 12 runs the same furnish of ground wood and sulphite to the beater was used in each case, the pulp consisting of quick-cook hemlock sulphite 25 per cent and experimental ground wood 75 per cent. In the last five tests the pulp was made up of 20 per cent of

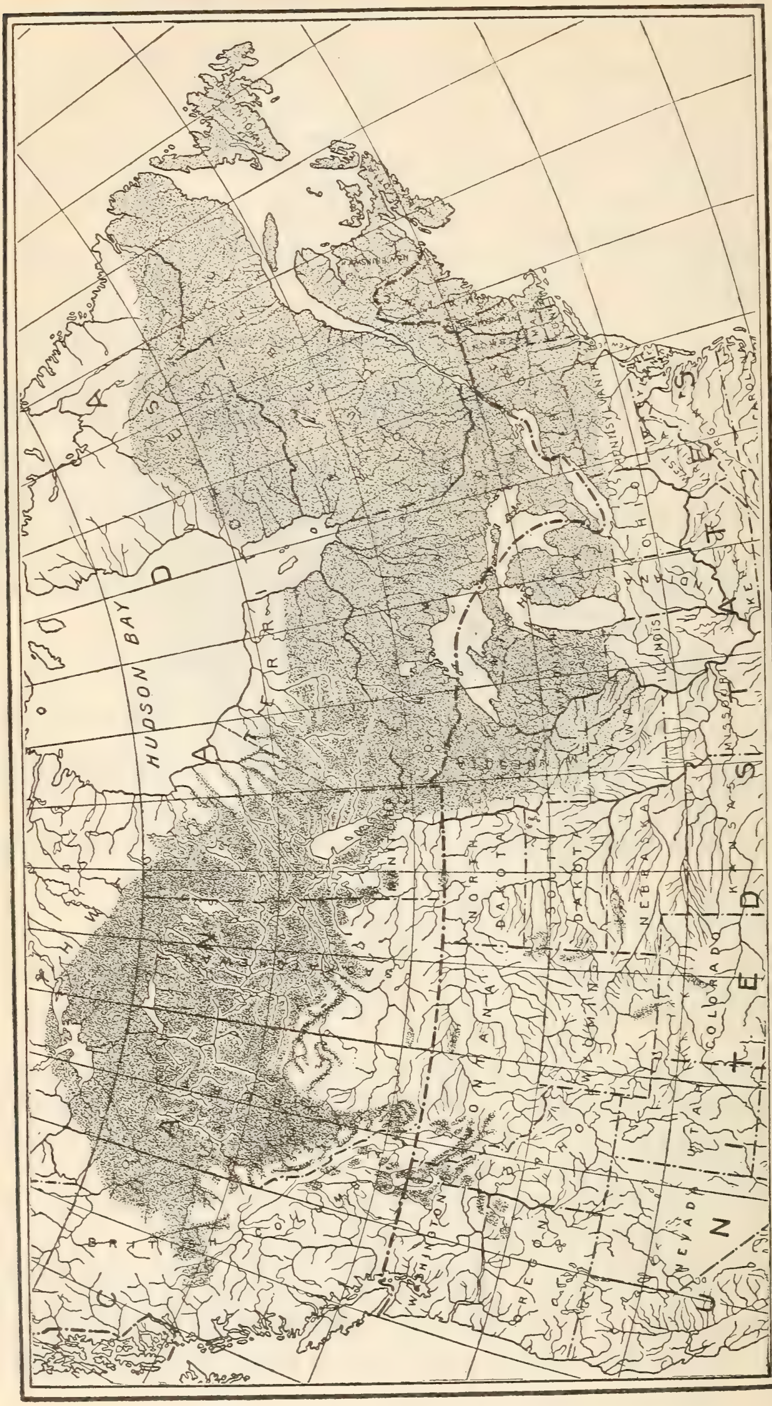


Fig. 43.—White birch (*Betula papyrifera*).

quick-cook sulphite and 80 per cent of ground wood. The complete list of material furnished the beaters is given in Table 2.

The quantities of the different colors added varied with the color of the pulp. In every case attempt was made to duplicate the standard news color used by the company manufacturing the paper. It is very probable that if the sheets had been left uncolored, or had

FIG. 44.—Black gum (*Nyssa sylvatica*).

been colored a cream white, they would have presented a better appearance than they did.

Of the first series of 12 tests, those on white spruce, balsam fir, and Sitka spruce were run on a Fourdrinier paper machine trimming 109 inches wide and having a jacketed upper couch roll. On account of the slowness of the stock and insufficient suction the operation of the pulps in these three tests was somewhat unsatisfactory. There was sticking of the pulp to the couch and difficulty in securing good formation.

TABLE 2.—*Furnish to beater on basis of 1,000 pounds of paper. Commercial tests on experimental pulps.*

Stock No.	Kind of ground wood.	Weight.	Sulphite.	Size.	Alum.	Soluble blue HA.	Rhodamine B extra.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Ounces.*	*Ounces.*
1	Spruce	750	250	3.33	6.67	3.2	0.167
2	Western hemlock	750	250	3.33	6.67	4.27	.10
3	Sitka spruce	750	250	3.33	6.67	3.37	.167
4	Lodgepole pine (Montana)	750	250	3.33	6.67	3.33	.20
5	Western yellow pine	750	250	3.33	6.67	4.27	.267
6	Balsam fir	750	250	3.33	6.67	2.53	.167
7	Lodgepole pine (California)	750	250	3.33	6.67	3.2	.167
8	Red fir	750	250	3.33	6.67	3.73	.133
9	Hemlock and spruce	[1] 750	250	3.33	6.67	3.73	.20
10	Balsam and spruce	[1] 750	250	3.33	6.67	2.6	.167
11	Tamarack	750	250	3.33	6.67	5.33	.667
12	Tamarack and spruce	[1] 750	250	3.33	6.67	4.00	.4
13	Noble fir	800	200	3.33	10.0	5.4	.40
14	Alpine fir	800	200	3.33	10.0	4.4	.40
15	White fir	800	200	3.33	10.0	6.8	.30
16	Engelmann spruce (Colorado)	800	200	3.33	10.0	4.8	.375
17	Amabilis fir	800	200	3.33	10.0	5.0	.400

[1] 375 pounds each.

The remainder of the 12 tests were run on a Fourdrinier machine trimming 100 inches and provided with a suction couch roll. The operation of pulp on this machine was much more satisfactory than on the other, although slowness of the stock made it impossible to use the dandy and a good formation could not be secured. Both of the paper machines ran at a speed of 460 feet per minute, and the screen plates were cut with slots 0.011 inch wide. In calendering the paper, 9 nips of a 12-roll calender stack were used.

So far as appearance and strength went, all the sheets manufactured at this time were considered very creditable. The No. 9 paper, containing 37½ per cent of hemlock ground wood, 37½ per cent of spruce ground wood, and 25 per cent of quick-cook hemlock sulphite, had a very high strength and took an excellent finish, though the color was slightly off. Both of the balsam sheets—No. 6 and No. 10—were very good both in strength and color. The western yellow-pine sheet ran very foamy and showed a number of scum spots, due largely to the pitch. Sheets of better formation undoubtedly could have been made if the pulp had been ground in a way to make it somewhat more "free." The jordan machine was not used except to brush out the sulphite.

For the last 5 of the 17 commercial runs it was necessary to return to the first paper machine. In this series the paper was run at a speed of 450 feet per minute and passed through 11 nips of a 12-roll calender stack. All of the stocks were somewhat slow, but not so slow as were those of the previous series. The formation of the sheets, however, left much to be desired. Engelmann spruce (stock 16) and Alpine fir (stock 14) operated very satisfactorily with the dandy in use, but the stock from amabilis fir (stock 17) was very slow and sticky, and the dandy was removed for noble fir (stock 13) and white fir (stock

15). In this series the jordan in every case brushed as close as, or closer than, when the regular mill stock was being used.

The ground wood from Alpine fir and Engelmann spruce gave the best results from the standpoint of operation on the paper machine. All of the sheets in this series exhibited very good strength, while the color of those from Alpine fir, amabilis fir, and Engelmann spruce compared favorably with that of the spruce standard. So far as the paper-making qualities of the pulps are concerned, the 17 tests demonstrate that all of the woods used are satisfactory for news-print paper. It was suggested by the men operating the paper machines that even more satisfactory results could have been secured had a lighter sheet been run, such as is used for catalogues. Table 58 summarizes the results of strength and color tests on the papers manufactured from the commercial pulp samples. If the results of the single trial to obtain a good color for each experimental sheet are compared with the color ratings given in Table 3 for a few actual trade news-print sheets, it will be seen that the latter vary almost as widely in color as the experimental papers.

TABLE 3.—*Color ratings of commercial news-print sheets.*

	Red.	Green.	Blue.	Black.		Red.	Green.	Blue.	Black.
A	61	59	54	126	K	66	61	59	114
B	61	57	50	132	L	68	60	58	114
C	66	62	59	112	M	71	61	59	109
D	61	59	54	126	N	58	56	56	130
E	69	65	60	106	O	65	58	57	120
F	70	66	54	110	P	56	55	55	134
G	61	59	54	126	Q	61	59	58	122
H	69	61	59	111	R	69	57	57	117
I	60	54	54	132	S	64	54	54	120
J	65	59	59	116					

TESTS ON NEWSPAPER PRESSES.

The final test of news-print paper is, of course, its behavior on the presses and the way it takes ink. Defects which are not apparent when the material is run over the machine become very evident when the paper is run through a high-speed press. Under such conditions, holes, calender cuts, and the like cause the paper to break.

The first 12 experimental papers were tested on the presses of the St. Louis Republic, St. Louis, Mo. They were run on two duplicate machines of the Hoe sextuple rotary type. Some of the rolls of experimental paper were 67 inches wide, others were $50\frac{1}{2}$ inches, and still others $33\frac{1}{2}$ inches wide. One entire city edition and a portion of another were printed on the experimental papers.

On one press the papers were run at the rate of 369 copies per minute, and on the other at the rate of 372 per minute, or 22,150 and 22,300 copies per hour, respectively. This corresponds to a speed of paper through the press of approximately 760 feet per minute.

Allowing for breaks and other interruptions, the actual number of papers printed per hour under ordinary conditions ranges from 10,000 to 19,000, depending on the quality of the paper used. In the case of the experimental papers none of the ordinary conditions of operation in the pressroom were changed in any particular. A single speed was maintained throughout the tests and the only adjustments made were those necessary to secure a good-looking sheet, such as changing the supply of ink to various portions of the type and adjusting the tension on the paper. Under ordinary conditions of operation in the pressroom of the St. Louis Republic there is one break to each ton (2,000 pounds) of paper run through the press. With the paper ordinarily used, 1,000 eight-page papers weigh 113 pounds. This corresponds to a sheet weighing approximately 31 pounds per ream of 500 sheets, 24 by 36 inches in size.

From Table 4, which gives the results of the printing tests, it will be seen that in some of the rolls, particularly those of white and Sitka spruce, there were a great many breaks. Almost all of these were due, however, to calender cuts on the edges of the sheets, scum spots, defective mill pasters, and poor winding. In the main, they were the result of inability to secure the best operating conditions on the paper machine before the supply of experimental pulp became exhausted. Difficulty with the spruces led us to believe that with proper operation on the machine practically all the trouble could have been eliminated.

TABLE 4.—*Printing-press data—experimental papers.*

ST. LOUIS REPUBLIC, APR. 29-30, 1913—67-INCH ROLLS.

Stock No.	Weight at mill.	Tare.[1]	Loss in transit.	Weight of wrapper.	Weight of paper at press.	Number of 8-page papers produced.[2]	Weight per 1,000 8-page papers.	Weight per 500 24 by 36 inch sheets.	Number of breaks.	Remarks.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		
6	1,015	50	12	13.5	939.5	8,950	104.97	28.64	......	Run good.
10	1,478	44	17	20.0	1,397	13,020	107.29	29.24	5	Breaks due to bad winding.
4	1,494	60	23	25.0	1,386	12,660	109.47	29.85	8	Breaks due to calender cut (and holes).
2	1,567	53	16	18.0	1,480	13,710	107.95	29.41	......	Run good.
8	1,513	44	......	20.0	1,449	11,890	121.86	33.22	......	Do.
7	1,516	43	16	18.0	1,439	12,030	119.61	32.61	......	Do.
5	1,425	56	21	22.0	1,326	11,850	111.89	30.49	6	Breaks due to calender cuts.
11	1,321	41	82	19.0	1,179	10,220	115.36	31.44	3	Breaks due to calender cuts (and holes).
12	1,473	44	11	19.5	1,398.5	11,370	123.00	33.56	1	Unknown (cuts on end of roll).
ST. LOUIS REPUBLIC, APR. 29-30, 1913—50¼-INCH ROLLS.										
1	1,046	44	10	12.0	980	11,600	112.64	30.71	8	Breaks due to bad winding.
1	1,191	33	......	6.0	1,152	13,580	113.10	30.84	3	2 breaks from scum spots, 1 from mill paster.
3	927	32	25	7.0	863	9,920	115.99	31.62	14	11 due to calender cuts, 3 to bad winding.
3	873	45	6	7.0	815	9,400	115.60	31.53	3	Due to calender cut and mill paster, cuts, and holes.
9	1,134	31	......	15.0	1,088	12,270	118.22	32.22	4	Do.
9	1,027	32	......	9.0	986	11,020	119.29	32.52	......	Run good.

TABLE 4—*Printing-press data—experimental papers*—Continued.

ST. LOUIS REPUBLIC, APR. 29-30, 1913—33½-INCH ROLLS.

Stock No.	Weight at mill.	Tare.[1]	Less in transit.	Weight of wrapper.	Weight of paper at press.	Number of 8-page papers produced.	Weight per 1,000 8-page papers.	Weight per 500 24 by 36 inch sheets.	Number of breaks.	Remarks.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		
6	464	22	9	12.0	421	8,590	98.02	26.74	1	Run good; mill paster.
NEW YORK HERALD, FEB. 14, 1914—66-INCH ROLLS.										
13	1,386	145	72	19.0	1,241	[3]12,170	101.96	30.0	......	Run fair; breaks due to bad winding.
14	1,361	97	44	19.0	1,245	[3]11,422	109.00	31.5	......	Run good.
15	1,346	340	280	19.0	987	[4]9,055	109.00	31.5	......	Do.
16	1,224	103	50	19.0	1,102	[3]9,325	118.18	34.0	......	Run fair.
17	1,181	80	40	19.0	1,082	[4]9,155	118.18	34.0	......	Run good.

[1] Figures for New York Herald run include waste and core.
[2] No data on number of spoils taken at St. Louis.
[3] 150 spoils.
[4] 100 spoils.

So far as inking qualities and finish were concerned, the experimental papers were entirely satisfactory. Many of the sheets, however, had a muddy appearance, particularly when placed beside the light-colored all-spruce sheet. It was the opinion of the pressmen that, notwithstanding this, most of the sheets were very fair. Those which seemed most promising were the balsam sheet (stock 6,) which ran very satisfactorily, though light in weight, and in color compared favorably with the all-spruce sheet, and stock 9, containing 37½ per cent of hemlock ground wood and 37½ per cent of spruce ground wood, which compared very favorably in color and printing qualities with ordinary news-print paper. Both of the lodgepole sheets and the red-fir sheet also had a good color. The tamarack sheets (stocks 11 and 12) ran well, but were dark. The following is an extract from the St. Louis Republic regarding the trial runs of the experimental papers.

The paper was used to print a part of the issue of the Republic on both Tuesday, April 29, and Wednesday, April 30, these trial runs being the first and only efforts so far made to use the experimental paper in a commercial way. The Republic volunteered to cooperate with the Government laboratory, and is gratified that it can report the paper used was of a quality to justify hopeful anticipation that substitute woods can be used which will serve to hold a good part of the paper-making industry on American soil. * * *

RESULTS ENCOURAGING.

As already remarked, the experimental runs developed results that were quite distinctly encouraging. These, however, can not be appraised with any measure of exactness for several reasons. First of these was the fact that there was not enough of any one particular make of paper to enable the pressmen in charge of the Republic's presses to acquire the familiarity that tends to good results. Sixteen rolls were sent for trial, and in only three instances were there as many as two rolls of the same par-

ticular composition. To make this handicap greater, it was necessary to constantly run two rolls of wholly different component materials at the same time, so that the press data was inevitably mixed and breaks in the running couldn't be traced with the same satisfactory certainty that would have followed if only one kind of a paper at a time had been running on a press. The weight of the paper was also extremely variable, and tension set for a roll running heavy would, of course, have to be set differently for another roll running much lighter in weight. Despite these handicaps the demonstration was notably satisfactory in respect to running strength in more than one instance.

The conventional standard of the paper mills, in the matter of weight, is 32 pounds for 500 sheets measuring 24 by 36 in size, yet one roll of the experimental paper, which weighed only 26.74 pounds, had but one break. This particular paper was made from balsam fir and was of unmistakably good quality apart from its quite surprising strength. Another roll of the same composition ran without a single break, and the trials apparently gave conclusive proof that balsam fir is good paper-making material. The red-fir paper also showed good results, but the weight being 33.22 pounds, the demonstration was not quite so conclusive.

SUCCESS WITH NEW MATERIALS.

Taking all factors into consideration, strength, color, and finish, the paper made from balsam and spruce ground wood in equal proportions, roll No. 10, stock number, was the most completely satisfactory. This paper weighed only 29.24 pounds, and the five breaks that occurred in running it were attributed entirely to improper winding. The paper made from white spruce ground wood showed unexpected lack of strength, speaking relatively, but, as might be assumed, was comparatively good in color. The matter of color is the point on which the most serious criticism can be made, but there is good reason for believing that this fault can be remedied. Consumers of paper always count on more or less difficulty at the start in getting the color established at a satisfactory standard, so this experimental paper can not be fairly condemned on that ground.

But one kind of chemical pulp was used in the manufacture of these rolls, as the list already given indicates. It was hemlock sulphite in every instance. One roll, stock No. 2, was made entirely from hemlock, both ground wood and chemical pulp. This paper was somewhat dark, but it showed good strength. The press report shows five breaks, but they are attributed to winding rather than to the weakness of the paper notwithstanding it averaged only 29.24 pounds. Paper manufacturers have used hemlock pulp for years to more or less extent, but usually mixed with spruce, and it has never been ranked in the same class as spruce in the matter of quality. Ground wood made from hemlock has a tendency to develop unfelted fiber that stands up like whiskers on the surface of the paper, but the paper made from the Wausau laboratory pulp was notably free from this particular bad quality.

The last five experimental paper stocks were tested on the presses of the New York Herald, New York City. A 66-inch roll of each paper, weighing approximately 1,200 pounds, was used. This amount was sufficient for only a part of one city edition. It was impossible, moreover, to run each stock over the same press, and the five rolls were divided among three Goss sextuple presses. In all cases the sheet was printed at the rate of 400 eight-page papers per minute, or 24,000 per hour, equal to a speed through the press of 760 linear feet per minute. As in the case of the tests at St. Louis, the pressmen did not depart from their ordinary practice except for slight adjustment of tension upon the sheet and impression

of the type required by the particular stock being printed. During shipment to New York the roll made from white fir (stock 15) and that from amabilis fir (stock 17) were considerably battered and torn at the edges. This caused the rolls to run unevenly at the start, though after a short time no trouble was experienced.

The paper from Alpine fir (stock 14) gave a good, clean, white sheet, had a good surface, took ink well, and from the printer's standpoint was considered the best sheet of the series. The amabilis fir paper (stock 17), although not as well formed, had a good surface, brought out the cuts fairly well, and was ranked second in the series. In general, the papers fed smoothly and the few irregularities met with were due to defects which could be easily prevented after a little experience in manufacture.

Following is an extract from the New York Herald in regard to the tests:

WORKS WELL ON PRESSES.

When the paper was all run off the foreman said he had had no more difficulty with the experimental Government paper than with any other that ever had been used on the presses. It fed smoothly, and while a slight imperfection appeared here and there, this was attributed to the mechanical irregularities and not to a fault of the pulp stock. The amabilis fir and the Alpine fir were credited with being the best, having a better finish, better surface, better color, and with a much better formation. * * *

The experimental runs developed results that showed that the Government paper was being printed under a handicap. In the first place, there was not enough of any one particular sample of the paper to enable the pressmen to acquire the familiarity that tends to the most perfect results.

With all the paper different in texture, thickness, weight, and formation, it was necessary to run rolls of differing texture together, so that the press data naturally were constantly mixed and the few breaks in the running could not be traced with the same satisfactory certainty that is the case when one kind of paper is feeding through all the parts of the press. The weight of the paper was also variable, compared one roll with another, and the tension set for a roll running heavy would, of course, have to be set differently for another roll running much lighter in weight.

DEMONSTRATION SATISFACTORY.

Another handicap under which the Government experts worked lay in the fact that they had made up such a small quantity of the paper that they naturally did not have as fine a quality as if they had been able to experiment with a dozen rolls before they finally adjusted their machines to the ultimate product. Moreover, in its shipment it had been damaged, so that it rolled unevenly. Despite these handicaps the demonstration was notably satisfactory.

The general impression of the press experts was that the amabilis fir and the Alpine fir had given the best results in the press. These rolls had a blue-white surface and general softness that made it almost impossible to distinguish them from spruce papers.

To obtain the opinions of paper producers and users, samples of the experimental sheets were submitted to a number of manufacturers and publishers. Their comments tend to show that different sheets are favored by different individuals, a fact which

would seem to indicate that almost every sheet is satisfactory to some critic. Some of the comments are as follows:

Some of the papers, especially Nos. 3 and 6, have beautiful color, but none of the samples are any darker than paper I have seen printed commercially, made from spruce ground wood and hemlock sulphite pulp. * * *

Personally I like the appearance of sheets Nos. 6, 9, and 10. Of these, I think sheet No. 9 shows up very well. I can not see why any one of these sheets could not be used for printing newspapers.

I find considerable variation in color when the samples are placed next to each other, but I do not think that the variation is so great that the reader's attention will be called to the color of the paper in any instance. In fact, I have seen many newspapers printed on paper made entirely from spruce wood which did not look nearly so well as the poorest of the samples submitted by you.

All of these samples on the last run seemed to show up very well indeed, and any one of them ought to serve for newspaper purposes.

PROBLEMS IN CONNECTION WITH THE EXPERIMENTAL WOODS.

Some of the woods tested are resinous, which makes them unsuitable for the manufacture of paper on a high-speed machine. There should be some inexpensive way of treating the resinous woods which would not darken them. It is possible that such treatment would have to be given in the beater. At the same time tests should be made on resinous woods at different times of the year, since it is likely that the time of cutting has a material influence on the operation of the pulp on the paper machine.

The color of many of the woods could probably be bettered by a suitable bleaching treatment while the pulp was being manufactured into laps or while the latter were being stored. Experiments might also be made to ascertain whether the sheets which are only slightly off color could not be brought up to the standard of white required for news-print purposes by the addition of dyes.

A problem not directly connected with pulp and paper production, but of importance to it, is that brought about by the decay of the wood when piled at the mill and of the pulp during storage. Some of the experimental woods decay rapidly and are subject to attacks of insects and fungi. Some reasonably cheap method of insuring these woods against decay and insects will have to be found if they are to be used in any quantity.

METHODS OF INCREASING THE EFFICIENCY OF GRINDING.

There are in the United States approximately 1,500 wood-pulp grinders of different sizes, each of which utilizes on the average 350 horsepower continuously. The amount of power applied to grinders has been increasing steadily from year to year. Where in the beginning of the mechanical pulp industry 125 horsepower was used on the grinder, in many cases now 600 to 750 horsepower is employed, and in the case of the automatic magazine grinder from 1,000 to 1,200 horsepower is utilized. Of the total number of grinders in the United States upon which information is available 36 per cent

are driven by turbines and motors of less than 300 horsepower capacity and 8 per cent of the grinders are driven by less than 200 horsepower. The work which has been described in this publication indicates that a large amount of power to the grinder is desirable. In order to utilize a large amount of power, the stones must be operated under conditions of high speed and high pressure, or they must be of a larger size than those used at the present time. Efficiency of grinding wood can be greatly increased over present average commercial practice by the use of higher pressure, since this results in the reduction of the horsepower consumption per ton of product. There are cases, of course, where such practice would not be desirable. If sulphite is available at low cost and power is expensive, this condition would surely obtain; but if sulphite is expensive and power can be secured at a low figure it is undoubtedly more economical to use a large amount of power per ton of product and make economies in sulphite by virtue of the fact that with the large amount of power better and stronger ground-wood fiber can be obtained.

Economies in grinding, particularly as related to power, depend largely on the character of the material into which the ground wood is to be incorporated. For the manufacturing of such materials as wood-pulp board, as used in the wall-board industry, a long, coarse fiber is required, and this is most desirable, since fibers of this nature do not form as dense a sheet. There are, as a result, a large number of air spaces present which retard the passage of cold and sound. For the production of pulp of this nature pulp stones of coarse grit are required which are softer than those usually employed for the manufacturing of pulps for other purposes. When using a coarse stone, a longer fiber can be obtained at higher pressure than when a finer stone is utilized. Consequently, it is desirable in the production of this character of stock to choose the pulp stone carefully to secure the best results. The matter of efficiency as applied to the manufacturing of stock for any desired purpose hinges, to a large measure, on a careful selection of the pulp stone to be used.

It is common practice in ground-wood mills to use all of the pockets on the grinder in the production of the mechanical pulp. In other words, the total amount of power available for use on the grinder is used on all of the pockets and at the same time. Power can be saved and the efficiency of production increased to a marked extent by the utilization of a fewer than the total number of pockets of the grinder. If four-pocket grinders are used, it is more desirable to use three of the pockets continuously and keep the fourth for surplus to be employed at times when one of the other pockets is being filled or when binding or other troubles are being corrected. When all of the power available on a three-pocket grinder is used

on three pockets, due to the need of filling and frequent binding of the wood in the cells, the total power is used about 88 per cent of the time. In other words, only 88 per cent of the power is being used continuously. When two pockets on the same three-pocket grinder are used to consume the total power and the third is kept for surplus, as previously outlined, all of the power is in use approximately 93 to 95 per cent of the time. Here a saving can be made and the efficiency increased without the installation or use of any additional apparatus, simply by means of increasing the pressure on the grinder cylinders, since this would be necessary if all of the power were applied to two instead of the three pockets on that piece of apparatus. Of course, this does not have as great bearing on the increasing of efficiency when grinders are motor driven; but in case of the direct connection to turbines it will be seen that it is of great consequence.

When grinders are motor driven, the most efficient utilization of the power can be accomplished by the installation of a grinder-cylinder pressure-regulating valve controlled electrically from the bus bars, the idea being to increase the pressure when for any reason the power consumption falls off.

Not only does the increasing of pressure on the cylinders result in the lowering of the horsepower consumption per ton, but there is at higher pressures an increase in the quantity of pulp which can be secured from a cord of wood, and this is another vital factor in the study of the efficiency of production of mechanical pulp. In any case it seems desirable to study carefully the grinding conditions, the speed of the pulp stone, the pressure employed, and the character and grit of the stone in use, since it is to these factors that practically all losses and gains can be traced. The manipulation of the grinder and its feeding and operation by the grinderman are also of prime importance, since without careful watching the binding of the wood in the pockets or some like difficulty may result in reduction of the production from the grinder and also in the lowering on quality of the resultant product. Even with careful watching there are times while the grinder is apparently running satisfactorily when hardly three-fourths of the total power available for its use is being consumed, due to the binding of the wood in the pockets.

FUTURE SUPPLIES FOR THE GROUND-WOOD INDUSTRY.

Of the woods tested, Alpine fir, Engelmann spruce, lowland fir, lodgepole pine, balsam fir, white fir, amabilis fir, noble fir, Sitka spruce, western hemlock, and eastern hemlock all give promise of being suitable for the production of news-print papers. Color is here the chief consideration. An acceptable news-print paper can not be made from such a dark-colored pulp as that of tamarack. Yet this does not bar tamarack as a raw material for the ground-wood industry; it will give a thoroughly satisfactory grade of yellow manila.

Similarly, jack pine, which is also unsatisfactory for news-print purposes, can be used very effectively in the manufacture of box boards. When combined with a large proportion of sulphite any of the woods tested, except the hardwoods, should produce a satisfactory manila of a color other than white. For the manufacture of wood-pulp boards, jack pine, tamarack, loblolly pine, and larch, in addition to the woods mentioned as suitable for news print, should furnish acceptable material. When high color is desired, and a somewhat poorer one in the center of the board is not objectionable, black gum or poplar could be used as a liner, if combined with a small percentage of sulphite. In the manufacture of box boards from steamed wood all of the conifers tested could be utilized, except where the product was to be a strong container board. The spruces, however, will yield a steamed pulp suitable for almost every kind of container.

It will be noted that the great majority of the substitute woods are confined to the West, while the ground-wood industry at present obtains the bulk of its supply of raw material from the East. The industry, however, is really a frontier one. It must have a plentiful supply of wood and an abundance of cheap power, two things not readily obtainable in settled communities. As the regions in which the industry is now centered develop it will have to move on to other and less-settled ones. On the National Forests are immense quantities of many of the woods tested and abundant opportunities for power development.

APPENDIX A.

List of tables contained in Appendix A.

TABLE 5.—*Grinder runs on white spruce.*

Run No.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood, bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
				Lbs. per sq. in.	*Lbs.*		*Feet per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*In.*	*Per cent.*	*Lbs.*	*Per cent.*	*Lbs.*	*°F*	
1	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	3	40; 50	16.4 20.5	175	2,445	403.0		4.988	80.8								171.0	
[1] 1	do	Same surface	3	40; 50	16.4 20.5	175	2,445	399.0		4.525	88.1								175.5	
	Total												29.1 28.4		27.00 29.00					
	Weighted averages							401.0		4.810	83.5	386.2	28.4		28.90	2,480	87.4	17.2	172.6	
2	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	3	40	16.4	200	2,795	398.0		4.245	93.8								164.3	0.00991
[1] 2	do	Same surface	3	40	16.4	200	2,795	408.0		3.995	102.0								171.3	.01017
[1] 2	do	do	3	40	16.4	200	2,795	394.0		4.175	94.4								166.7	.00981
	Total												22.72		39.33					
	Weighted averages							402.0		4.120	97.5	409.5				2,012	88.5	13.75	168.0	.01002
[1] 3	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	3	20	8.2	175	2,445	191.0	215	1.215	157.0	105.4	27.66		30.14	2,300	83.2	9.82	163.0	.00954
[1] 4	do	Same surface	3	40	16.4	175	2,445	333.0	388	3.025	110.0	251.3	27.66		30.14	2,408	87.1	17.80	166.5	.00830
[1] 5	do	do	3	60	24.65	175	2,445	454.0	506	5.255	86.4	436.0	27.66		30.14	2,415	87.3	18.60	152.2	.00753
[1] 6	do	do	3	20	8.2	225	3,145	225.0	264	1.198	188.0	106.2	27.66		30.14	2,255	81.5	9.66	179.8	.00873
[1] 7	do	do	3	40	16.4	225	3,145	412.0	494	3.775	109.0	314.0	27.66		30.14	2,404	87.0	10.15	163.8	.00799
[1] 8	do	do	3	60	24.65	225	3,145	567.0	651	6.215	91.2	474.5	27.66		30.14	2,624	95.0	15.70	158.3	.00731
[1] 9	Spiral, cut 6 to inch	Stone dressed	3	20	8.2	175	2,442	174.7	222	.995	175.5	93.7	27.66		30.14	2,122	76.8	13.54	165.5	.008715
[1] 10	do	do	3	40	16.4	175	2,442	287.0	357	3.850	74.5	311.0	27.66		30.14	2,478	89.5	21.10	139.2	.007155
[1] 11	do	Same surface	3	60	24.65	175	2,442	397.0	480	6.060	65.5	505.0	27.66		30.14	2,400	86.8	56.50	142.2	.00659
[1] 12	do	do	3	20	8.2	225	3,140	225.0	280	2.995	75.2	216.6	27.66		30.14	2,302	83.3	19.57	154.0	.00874
[1] 13	do	do	3	40	16.4	225	3,140	356.0	431	5.305	67.2	431.0	27.66 28.11		30.14 29.04	2,464	88.7	16.75	137.0	.00691

[1] 14	....do....	....do....	3	60	24.65	225	3,140	508.0	586	7.840	64.9	654.0	28.11	......	29.04	2,400	85.4	30.95	135.7	.00656
[1] 9-1	....do....	....do....	3	20	8.2	175	2,442	178.5	212	1.910	93.5	166.4	27.52	......	29.29	2,295	83.5	12.60	144.2	.00891
[1] 15	Diamond point, cut 8 to inch.	Stone dressed....	3	20	8.2	175	2,442	183.0	210	1.435	127.6	120.3	27.52	......	29.29	2,390	81.9	11.05	163.0	.00913
[1] 16	....do....	Same surface....	3	40	16.4	175	2,442	327.0	388	3.705	88.2	326.0	27.59	......	27.81	2,272	82.4	13.20	147.0	.00815
[1] 17	....do....	....do....	3	60	24.65	175	2,442	426.0	489	5.340	79.8	455.0	27.59	6⅛	27.81	2,345	85.0	9.84	141.0	.00707
[1] 18	....do....	....do....	3	20	8.2	225	3,140	234.0	287	2.088	112.0	181.0	27.59	5¾	27.81	2,307	83.7	7.75	158.2	.00909
[1] 19	....do....	....do....	3	40	16.4	225	3,140	379.0	441	4.220	89.8	359.0	27.59	6	27.81	2,350	85.2	12.60	151.8	.00735
[1] 20	....do....	....do....	3	60	24.65	225	3,140	521.0	592	6.360	82.0	534.5	29.12	5⅛	27.32	2,380	81.8	11.50	148.6	.006735
[1] 21	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed....	3	40	16.4	175	2,442	312.0	378	2.155	144.8	200.0	27.80	3⅝	27.42	2,155	77.5	7.45	170.8	.00778
[1] 22	....do....	Same surface....	3	40	16.4	175	2,442	321.0	365	2.260	142.0	197.5	28.34	8¾	27.57	2,290	80.8	7.73	171.5	.00800
[1] 23	....do....	....do....	3	40	16.4	175	2,442	324.0	372	2.415	134.0	267.5	21.08	14	37.74	1,820	86.3	7.84	163.1	.008085
[1] 24	....do....	Stone dressed....	3	60	24.65	100	1,398	299.0	359	3.005	99.5	255.0	27.60	5¾	31.70	2,360	85.5	12.90	140.2	.00867
[1] 25	....do....	Same surface....	3	50	24.65	150	2,093	416.0	478	4.655	89.4	382.0	29.05	5⅝	27.90	2,440	84.0	20.00	149.5	.00807
[1] 26	....do....	....do....	3	60	24.65	200	2,792	529.0	605	5.960	88.7	481.6	29.05	5⅝	27.90	2,476	85.1	20.06	149.3	.00768
[1] 27	....do....	....do....	3	60	24.65	250	3,490	640.0	731	7.850	81.5	675.0	27.02	5	28.40	2,326	86.0	11.00	138.6	.00743
[1] 28	....do....	....do....	3	30	12.36	250	3,490	350.0	397	2.938	119.2	251.5	28.68	5⅝	30.40	2,340	81.5	8.54	163.2	.00811
[1] 29	....do....	....do....	3	40	16.4	188	2,624	355.0	428	2.950	120.3	247.0	28.68	5¾	30.40	2,390	83.3	11.20	171.3	.00824
[1] 30	....do....	....do....	3	50	20.5	150	2,093	356.0	391	3.850	92.5	318.0	26.88	5⅝	31.00	2,420	90.0	9.94	146.3	.00830
[1] 31	....do....	....do....	3	60	24.65	125	1,745	358.0	398	3.580	100.0	306.0	26.88	5⅞	31.00	2,340	87.0	15.00	151.0	.008315
[1] 29-1	....do....	....do....	3	40	16.4	188	2,624	343.0	407	2.685	127.7	236.2	27.24	5⅝	28.30	2,275	83.5	10.27	172.8	.00796
[1] 32	....do....	Stone dressed....	3	30	12.3	250	3,470	314.0	385	5.200	60.4	441.5	27.24	5⅜	28.30	2,355	86.6	13.2	124.4	.00736
[1] 33	....do....	Same surface....	3	35	14.36	214	2,970	344.0	404	6.040	57.0	505.0	27.24	5⅞	28.30	2,390	87.8	12.05	131.5	.00806
[1] 34	....do....	....do....	3	40	16.4	188	2,609	320.5	389	5.290	60.6	452.0	27.24	5⅛	28.30	2,338	85.8	14.18	123.2	.00749
[1] 35	....do....	....do....	3	45	18.46	167	2,318	341.0	392	5.255	64.9	444.0	27.35	5½	29.98	2,370	86.6	10.48	128.0	.007975
[1] 36	....do....	....do....	3	50	20.5	150	2,081	339.0	399	5.230	64.8	445.0	27.35	5½	29.98	2,355	86.1	13.22	127.4	.00795
[1] 37	....do....	....do....	3	55	22.6	136	1,887	328.0	381	5.200	63.1	432.0	27.35	5¾	29.98	2,410	88.1	18.96	129.5	.00770
[1] 38	....do....	....do....	3	60	24.65	125	1,734	327.0	380	4.870	67.1	428.0	27.35	5⅞	29.98	2,280	83.4	21.80	131.7	.00765
[1] 39	....do....	Stone dressed....	3	50	20.5	200	2,775	429.0	495	5.875	73.0	502.0	27.60	5½	31.40	2,340	84.8	13.20	86.0	.00754
[1] 40	....do....	Same surface....	3	50	20.5	200	2,775	400.5	481	5.240	76.5	434.0	27.60	5½	31.40	2,418	87.6	13.13	116.6	.00704
[1] 41	....do....	....do....	3	50	20.5	200	2,775	453.0	515	6.210	72.9	529.0	27.60	5⅛	31.40	2,350	85.2	17.92	159.3	.00797
[1] 42	....do....	....do....	3	20	8.2	175	2,428	164.0	183	1.640	101.2	132.0	28.35	5⅝	33.25	2,455	86.5	6.83	85.0	.00824
43	....do....	....do....	3	40	16.4	175	2,428	315.5	366	3.110	101.3	252.0	28.35	5	33.25	2,470	87.0	7.98	87.8	.00792
[1] 44	....do....	....do....	3	60	24.65	175	2,428	442.0	526	5.145	86.0	392.0	28.35	6	33.25	2,620	92.4	13.12	86.7	.00739
[1] 45	....do....	....do....	3	20	8.2	175	2,428	177.7	209	1.105	160.7	89.1	28.35	5⅞	33.25	2,480	87.5	11.90	176.3	.00892
[1] 46	....do....	....do....	3	40	16.4	175	2,428	323.0	360	3.410	94.7	350.0	22.40	6¼	44.00	1,950	87.0	9.50	152.7	.00778
[1] 47	....do....	....do....	3	60	24.65	175	2,428	449.0	531	5.610	79.9	582.0	22.40	6½	44.00	1,930	86.1	15.83	145.0	.00719
[1] 48	....do....	....do....	3	20	8.2	175	2,428	176.8	222	1.350	131.0	144.6	22.40	6⅜	44.00	1,870	83.5	3.48	86.4	.00888
[1] 49	....do....	....do....	3	40	16.4	175	2,428	320.0	406	2.820	113.5	289.0	22.40	6	44.00	1,952	87.2	8.45	86.0	.00803
[1] 50	....do....	....do....	3	60	24.65	175	2,428	435.0	487	4.680	93.0	461.0	22.40	6½	44.00	2,030	90.6	9.22	89.3	.00726
[1] 52	....do....	Stone dressed....	2	20	8.2	225	3,107	148.0	160	.816	181.2	80.0	26.61	5⅝	24.14	2,040	76.6	6.65	171.3	.00581
[1] 53	....do....	Same surface....	2	40	16.4	225	3,107	282.0	334	2.695	104.7	249.0	26.61	6¾	24.14	2,160	81.1	9.70	159.3	.00553
[1] 54	....do....	....do....	2	60	24.65	225	3,107	394.0	447	5.770	68.3	519.0	26.34	4⅝	25.12	2,225	84.5	11.40	137.8	.00514
[1] 55	....do....	....do....	2	80	32.8	225	3,107	497.0	551	8.340	59.6	738.0	26.34	4⅝	25.12	2,258	85.7	15.85	136.3	.00487
[1] 56	....do....	....do....	2	100	41.0	225	3,107	556.0	621	9.770	57.0	860.0	26.34	5⅜	25.12	2,272	86.2	20.24	133.7	.00436
[1] 58	....do....	Stone dressed....	2	40	16.4	250	3,452	285.0	326	4.600	62.0	403.0	26.34	6¼	25.12	2,280	86.6	7.35	139.1	.00504
[1] 59	....do....	Same surface....	2	60	24.64	250	3,452	426.0	460	Stone too sharp and pulp too short for test to be of any practical value; data discarded.										.00500

[1] Seasoned wood used.

TABLE 5.—*Grinder runs on white spruce*—Continued.

Run No.	Stone. Kind of burr	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood, bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
				Lbs. per sq. in.	*Lbs.*		*Feet per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*In.*	*Per cent.*	*Lbs.*	*Per cent.*	*Lbs.*	*°F.*	
[1] 60	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	3	40	16.4	100	1,381	194.0	242	2.110	92.0	190.0	27.11	5	25.31	2,220	81.9	9.43	141.5	0.00856
[1] 61	do	Same surface	3	40	16.4	150	2,071	275.0	318	3.005	91.5	271.0	25.03	4¾	30.54	2,218	88.5	11.16	146.8	.00810
[1] 62	do	do	3	40	16.4	200	2,762	354.0	427	4.080	86.7	358.0	25.03	5½	30.54	2,280	91.0	8.50	143.9	.00781
[1] 63	do	do	3	40	16.4	250	3,452	407.0	460	4.980	81.8	439.0	25.03	5¼	30.54	2,270	90.6	7.91	144.1	.00720
[1] 64	do	do	3	60	24.65	100	1,381	275.0	322	3.500	78.6	303.0	25.72	5⅛	28.83	2,310	89.9	18.27	141.1	.00806
[1] 65	do	do	3	60	24.65	150	2,071	362.0	419	4.500	80.5	398.0	25.72	5½	28.83	2,262	88.0	11.82	137.7	.00709
[1] 66	do	do	3	60	24.65	200	2,762	481.0	560	5.800	83.0	505.0	25.72	5⅝	28,83	2,298	89.3	12.32	143.0	.00706
[1] 67	do	do	3	60	24.65	250	3,452	546.0	620	7.335	74.5	675.0	25.08	5⅞	27.64	2,170	86.5	13.53	140.0	.00641
[1] 68	do	do	2	40	16.4	250	3,452	304.0	350	3.715	81.8	336.0	25.88	6⅛	27.34	2,210	85.4	7.22	144.8	.00536
[1] 69	do	do	2	60	24.65	250	3,452	401.0	431	5.590	71.8	489.0	25.88	5⅜	27.34	2,280	88.1	10.22	138.8	.00471
[1] 70	do	do	2	80	32.8	250	3,452	510.0	564	8.100	63.0	709.0	25.94	5⅛	28.40	2,285	88.1	13.28	134.6	.00450
[1] 71	do	do	2	100	41.0	250	3,452	543.0	661	8.930	60.8	780.0	26.15	6	32.38	2,288	87.5	11.26	129.2	.00384
[2] 74	do	Same as No. 73	3	60	8.2	175	2,417	451.5	502	5.025	89.9	492.0	27.09	6¼	39.70	2,042	75.5	9.90	145.4	.00760
[2] 75	do	Same surface	3	40	16.4	175	2,417	330.0	367	2.900	113.8	275.0	27.09	7	39.70	2,110	77.9	7.60	149.2	.00833
[2] 76	do	do	3	20	24.65	175	2,417	185.7	239	.987	188.0	98.5	27.09	6¾	39.70	2,004	74.1	5.67	174.1	.00938
[1] 80	do	Same as No. 79	3	20	8.2	175	2,417	183.0	239	.640	286.0	63.5	27.47	5⅝	28.33	2,016	74.3	10.43	181.8	.00925
[1] 81	do	Same surface	3	40	16.4	175	2,417	334.0	392	2.525	132.2	237.0	27.47	5⅝	28.33	2,125	77.4	10.40	161.2	.00843
[1] 82	do	do	3	60	24.65	175	2,417	449.0	527	4.590	97.8	413.0	27.47	5⅝	28.33	2,220	80.8	15.07	148.0	.00754
[2] 83	do	do	3	60	24.65	100	1,381	281.0	323	2.850	98.6	269.0	27.09	7¼	39.70	2,120	78.2	15.05	148.1	.00824
[2] 84	do	do	3	60	24.65	150	2,072	414.0	467	3.530	117.2	309.0	27.12	6¼	37.56	2,284	84.4	20.5	155.8	.00810
[2] 85	do	do	3	60	24.65	200	2,762	495.0	550	5.350	92.6	481.0	27.12	6½	37.56	2,220	81.9	14.21	148.7	.00726
[2] 86	do	do	3	60	24.65	250	3,452	608.0	677	6.875	88.4	686.0	26.38	8	40.15	2,004	76.1	10.40	143.6	.00714
[2] 87	do	do	2	40	16.4	250	3,452	315.0	358	2.600	121.1	260.0	26.38	7½	40.15	2,000	75.9	6.14	161.0	.00556
[2] 88	do	do	2	60	24.65	250	3,452	439.0	485	3.840	114.2	405.0	25.15	7¾	41.24	1,893	75.4	10.46	169.0	.00515
[2] 89	do	do	2	80	32.8	250	3,452	560.0	609	6.520	85.9	675.0	25.15	6½	41.24	1,932	77.0	13.18	147.6	.00495
[2] 90	do	do	2	100	41.0	250	3,452	640.0	699	8.140	78.6	823.0	25.15	6¼	41.24	1,978	78.7	13.59	150.3	.00452
[2] 91	do	do	3	54	22.15	250	3,452	554.0	610	4.755	116.4	482.0	25.15	6½	41.24	1,972	78.5	9.25	161.1	.00725

[1] 92	Diamond point, cut 6 to inch.	Stone dressed	2	100	41.0	250	3,452	650.0	723	Qualitative run; no production data.			27.51	6½	27.47	......	......	......	126.5	.00460
[1] 93	.....do	Same surface	2	20	8.2	250	3,452	256.5	286				27.51	6½	27.47	......	......	......	136.0	.00906
[1] 94	Spiral, cut 6 to inch	Stone dressed	2	100	41.0	250	3,435	572.5	653				27.51	5⅜	27.47	......	......	......	107.6	.00407
[1] 95	.....do	Same surface	2	20	8.2	250	3,435	232.5	278				27.51	5⅜	27.47	......	......	......	110.6	.00826
[1] 96	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	2	40	16.4	200	2,748	310.0	390				27.51	5⅜	27.47	......	......	......	113.6	.00687
[1] 112	.....do	Same as No. 111	3	40	16.4	200	2,748	326.0	392	4.320	75.5	380.0	27.00	5⅝	23.84	2,270	84.3	8.41	141.8	.00723
[2] 114	.....do	Same as No. 113	3	40	16.4	200	2,748	342.0	388	4.625	73.9	405.0	27.19	6	39.66	2,282	84.1	7.96	110.9	.00758
[2] 120	.....do	Same as No. 119	1	120	49.2	225	3,092	307.0	370	5.260	58.3	513.0	25.05	5⅞	40.34	2,055	82.0	13.42	124.5	.00202
[2] 121	.....do	Same surface	2	59.5	24.4	225	3,092	347.0	392	5.280	65.7	496.0	25.05	6	40.34	2,130	85.0	8.44	128.1	.00460
[2] 122	.....do	.....do	3	36.5	14.98	225	3,092	335.0	411	3.770	88.9	360.0	25.05	6	40.34	2,093	83.5	5.22	149.5	.00724
[2] 123	.....do	.....do	3	60	24.65	225	3,092	493.0	556	5.665	87.0	629.0	24.84	6¼	43.02	1,805	72.6	6.95	133.7	.00646
[2] 124	.....do	Stone dressed	3	60	24.65	225	3,085	595.0	665	7.485	79.5	790.0	24.84	6½	43.02	1,898	76.3	10.40	137.8	.00781
[2] 125	.....do	Same surface	3	40	16.4	225	3,085	419.0	475	4.390	95.5	426.0	24.84	6	43.02	2,058	82.7	6.79	141.3	.00826
[2] 126	.....do	.....do	3	20	8.2	225	3,085	232.0	290	1.703	136.2	176.0	24.84	6¾	43.02	1,928	77.5	5.37	163.8	.00916
[1] 127	.....do	.....do	3	60	24.65	225	3,085	567.0	629	6.95	81.6	577.0	28.01	5⅜	29.09	2,405	85.9	15.90	145.0	.00745
[1] 128	.....do	.....do	3	40	16.4	225	3,085	417.0	469	4.490	93.0	374.0	28.01	5	29.09	2,402	85.8	13.53	153.8	.00825
[1] 129	.....do	.....do	3	20	8.2	225	3,085	231.0	264	1.517	152.2	129.0	28.01	5¼	29.09	2,350	83.9	11.89	167.0	.00913
[1] 133	.....do	Same as No. 132	3	40	16.4	225	3,085	413.0	496	4.750	87.0	402.0	27.66	4⅝	28.08	2,360	85.4	8.39	133.2	.00816
[1] 134	.....do	Same surface	3	40	16.4	225	3,085	411.0	478	4.210	97.8	353.0	27.66	5	28.08	2,380	86.0	13.34	172.0	.00813
[1] 135	.....do	.....do	2	60	24.65	225	3,085	403.0	470	5.765	69.9	469.0	27.96	4⅝	26.41	2,460	88.0	10.70	121.4	.00530
[1] 136	.....do	.....do	2	60	24.65	225	3,085	416.0	472	5.785	72.0	475.0	27.96	5⅛	26.41	2,435	87.0	13.75	173.0	.00547
[1] 137	.....do	.....do	3	20	8.2	175	2,400	188.0	215	1.465	128.3	119.6	28.04	5½	27.75	2,450	87.4	10.30	148.3	.00955
[1] 138	.....do	.....do	3	40	16.4	175	2,400	338.0	384	3.435	98.5	278.0	28.04	5½	27.75	2,470	88.0	9.45	150.1	.00859
[1] 139	.....do	.....do	3	60	24.65	175	2,400	462.0	515	5.805	79.6	466.0	28.04	5¼	27.75	2,490	88.7	10.97	140.0	.00780
[1] 140	.....do	.....do	3	20	8.2	175	2,400	180.0	225	1.419	127.0	115.8	28.04	5½	27.75	2,450	87.4	10.70	159.3	.00915
[1] 141	.....do	.....do	3	40	16.4	175	2,400	323.0	346	3.495	92.5	282.0	28.04	6	27.75	2,480	88.4	12.11	152.9	.00821
[1] 142	.....do	.....do	3	60	24.65	175	2,400	465.0	515	5.775	80.5	475.0	28.04	5⅜	27.75	2,435	86.7	14.51	146.5	.00785
[1] 143	.....do	Same as No. 142	3	60	24.65	225	3,085	572.0	655	6.875	83.3	591.0	26.97	5½	27.05	2,325	86.4	14.49	150.0	.00751
[1] 144	.....do	Same surface	3	60	24.65	225	3,085	555.0	634	6.585	84.4	564.0	26.97	5½	27.05	2,335	86.6	14.83	157.8	.00729
[1] 145	.....do	.....do	3	60	24.65	225	3,085	586.0	665	7.405	79.1	625.0	26.97	5⅜	27.05	2,370	88.0	14.81	162.8	.00770
[1] 146	.....do	.....do	3	50	20.5	100	1,371	247.5	283	2.570	96.2	217.5	27.19	5⅝	26.12	2,360	86.9	15.89	154.0	.00880
[1] 147	.....do	.....do	2	50	20.5	150	2,056	254.0	295	2.880	88.2	245.0	27.19	5	26.12	2,350	86.5	13.73	154.9	.00603
[1] 148	.....do	.....do	1	50	20.5	250	3,427	222.0	254	2.590	85.7	213.3	27.19	6	26.12	2,370	87.1	12.38	147.1	.00316
[1] 149	.....do	.....do	3	50	20.5	100	1,371	266.0	294	2.617	101.7	224.0	27.19	4¾	26.12	2,340	86.1	18.53	162.0	.00945
[1] 150	.....do	.....do	2	50	20.5	150	2,056	263.0	284	2.685	97.9	227.8	27.19	6⅜	26.12	2,360	86.9	9.69	161.0	.00624
[1] 151	.....do	.....do	1	50	20.5	250	3,427	226.0	265	2.405	94.0	206.0	27.19	5	26.12	2,335	85.9	11.63	155.0	.00322
[1] 152	.....do	Same as white birch No. 2.	3	30	12.3	225	3,085	324.0	362	1.890	171.3	190.6	24.13	9⅝	32.00	1,983	82.3	11.30	181.9	.00853
[1] 153	.....do	Same as tamarack, No. 26.	3	30	12.3	225	3,085	298.0	340	1.233	241.8	116.3	26.91	5	22.93	2,120	78.9	17.57	186.0	.00785
[1] 154	.....do	Same surface	2	100	41.0	225	3,085	652.0	706	6.490	100.6	637.0	26.91	5	22.93	2,035	75.6	25.78	152.0	.00515
[1] 155	Straight, cut 3 to inch; spiral, cut 10 to inch.	Same as run No. 12 Montana lodgepole pine.	3	40	16.4	225	3,085	444.0	489	2.205	200.6	194.6	28.20	5	22.10	2,270	80.5	5.05	86.5	.00876
[1] 156	.....do	Same surface	3	40	16.4	225	3,085	382.0	446	1.825	209.4	163.0	28.20	4⅞	22.10	2,240	79.5	12.31	137.2	.00754
[1] 157	.....do	.....do	2	80	32.8	225	3,085	511.0	571	3.850	133.0	339.0	28.20	5	22.10	2,270	80.5	9.39	86.0	.00505
[1] 158	.....do	.....do	2	80	32.8	225	3,085	474.0	509	4.160	113.9	363.0	28.20	5¼	22.10	2,290	81.2	20.70	169.0	.00468
[1] 159	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	3	30	12.3	250	3,427	316.0	368	2.685	117.7	254.0	25.14	6⅞	34.14	2,110	84.0	6.90	167.6	.00750

[1] Seasoned wood used.

[2] Green wood used.

TABLE 5.—*Grinder runs on white spruce*—Continued.

Run No.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood, bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
				Lbs. per sq. in.	*Lbs.*		*Feet per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*In.*	*Per cent.*	*Lbs.*	*Per cent.*	*Lbs.*	*° F.*	
[1] 160	Straight, cut 3 to inch; spiral, cut 10 to inch.	Same surface	3	30	12.3	250	3,427	308.0	338	2.250	136.8	190.3	26.48	5¼	31.12	2,365	89.4	11.37	158.3	0.00730
[1] 161	....do	....do	3	35	14.35	214	2,936	328.0	368	2.210	148.2	191.6	26.48	4½	31.12	2,310	87.1	9.10	178.2	.00779
[1] 162	....do	....do	3	40	16.4	188	2,580	317.0	350	2.425	130.8	206.0	26.48	5½	31.12	2,350	88.7	9.81	169.3	.00750
[1] 163	....do	....do	3	45	18.45	167	2,290	339.0	380	2.825	120.0	230.0	26.48	5⅜	31.12	2,455	92.6	13.26	166.6	.00802
[1] 164	....do	....do	3	50	20.5	150	2,056	323.0	361	2.445	132.1	204.5	26.48	5½	31.12	2,385	90.1	11.62	158.2	.00767
[1] 165	....do	....do	3	55	22.55	136	1,867	310.0	347	2.265	136.7	196.0	26.48	5½	31.12	2,310	87.1	11.70	165.1	.00736
[1] 166	....do	....do	3	60	24.65	125	1,714	323.0	386	2.775	116.5	236.0	26.48	5⅝	31.12	2,350	88.7	16.45	155.7	.00764
[1] 177	Diamond point, cut 8 to inch.	Same as No. 176	2	20	8.2	225	3,085	157.5	194	.760	207.0	68.7	27.54	4½	27.98	2,210	80.3	10.75	161.2	.00622
[1] 178	....do	Same surface	2	40	16.4	225	3,085	280.0	314	2.240	125.0	193.0	27.54	4¾	27.98	2,315	84.0	9.02	160.0	.00553
[1] 179	....do	....do	2	60	24.65	225	3,085	387.0	455	4.095	94.5	342.0	27.54	4⅛	27.98	2,390	86.9	10.27	137.5	.00508
[1] 180	....do	....do	2	80	32.8	225	3,085	485.0	530	5.545	87.5	468.0	27.54	5¼	27.98	2,370	86.0	10.90	126.4	.00479
[1] 181	....do	....do	2	100	40.0	225	3,085	563.0	630	7.450	75.5	645.0	27.54	5⅛	27.98	2,310	83.9	16.57	126.7	.00445
[1] 210	Spiral, cut 8 to inch	Stone dressed	3	50	20.5	200	2,728	410.0	469	1.260	325.0	Axis of wood was perpendicular to axis of stone. No production data.							166.0	....
[1] 222	Straight, cut 3 to inch; spiral, cut 12 to inch.	....do	2	80	32.8	225	3,069	474.0	566	6.610	71.6	551.0	25.37	6¾	32.24	2,400	94.6	14.65	146.0	.00470
[1] 243	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as lowland fir No. 17.	2	40	16.4	175	2,348	219.0	263	1.750	125.0	148.0	25.63	4⅞	34.83	2,365	92.2	7.10	158.0	.00569
[1] 244	....do	Same surface	2	60	24.65	175	2,348	306.0	346	3.145	97.3	261.0	25.63	4⅜	34.83	2,412	94.0	12.10	142.0	.00528
[1] 245	....do	....do	2	80	32.8	175	2,348	370.0	450	4.375	84.5	360.0	25.63	5	34.83	2,430	94.8	13.10	142.0	.00480
[1] 246	....do	....do	2	60	24.65	100	1,342	212.0	238	2.175	97.4	181.0	25.63	4¾	34.83	2,410	94.0	10.60	145.0	.00640
[1] 247	....do	....do	2	60	24.65	250	3,355	411.0	465	3.870	106.0	315.0	25.63	4½	34.83	2,460	96.0	9.10	150.0	.00497
[1] 248	....do	Stone dressed	2	60	24.65	175	2,348	316.0	372	4.740	66.5	420.0	25.63	4⅝	34.83	2,260	88.1	8.2	96.0	.00545
[1] 249	....do	....do	2	60	24.65	175	2,348	321.0	380	1,700	189.0	189.0	25.63	5¼	34 83	1,803	70.4	4.9	79.0	.00554
[1] 250	....do	Same surface	2	60	24.65	175	2,348	312.0	400	2.030	153.7	187.0	25.63	5½	34.83	2,170	84.6	7.6	151.0	.00538
[1] 251	....do	....do	2	60	24.65	175	2,348	304.0	369	2.080	146.0	193.0	25.63	4⅞	34.83	2,150	83.9	10.4	170.0	.00524
[1] 252	....do	....do	3	50	20.50	225	3,020	436.0	531	2.025	215.0	191.0	25.50	5⅜	33.1	2,120	82.6	8.2	176.0	.00705
[1] 253	....do	....do	3	50	20.50	225	3,020	457.0	550	2.560	178.5	226.0	25.50	5½	33.1	2,260	88.1	6.4	154.0	.00739
[1] 254	....do	....do	3	50	20.50	225	3,020	527.0	641	2.570	205.0	242.0	25.50	5	33.1	2,120	82.6	......	80.0	.00852

[2] 255	.....do....................	Same as black gum No. 13.	3	40	16.40	175	2,348	258.0	314	2.845	90.6	391.0	18.60	12¼	30.80	1,455	78.3	12.3	130.0	.00670
[2] 256	.....do....................	Same as No. 255..	3	40	16.40	175	2,348	290.0	342	2.250	129.0	194.0	25.83	4⅝	29.66	2,320	89.9	14.2	147.0	.00753
[1] 257	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed.....	3	20	8.20	175	2,425	176.0	204	1.190	148.0	111.0	24.36	4½	28.73	2,140	88.0	22.5	170.0	.00885
[1] 258	.....do....................	Same surface......	3	40	16.40	175	2,425	331.0	415	3.450	96.0	318.0	24.36	4¼	28.73	2,170	89.1	35.9	156.0	.00832
[1] 259	.....do....................	.....do............	3	60	24.65	175	2,425	514.0	565	7.460	68.8	670.0	24.36	4⅜	28.73	2,230	91.6	74.0	152.0	.00859
[1] 260	.....do....................	.....do............	3	40	16.40	100	1,387	235.0	277	2.410	97.5	220.0	24.36	4¼	28.73	2,185	88.9	32.6	157.0	.01032
[1] 261	.....do....................	.....do............	3	40	16.40	150	2,080	358.0	392	4.270	83.6	395.0	24.36	4⅜	28.73	2,160	88.8	56.6	150.0	.01049
[1] 262	.....do....................	.....do............	3	40	16.40	200	2,774	426.0	478	4.820	88.3	433.0	24.36	4¼	28.73	2,220	91.2	30.0	145.0	.00936
[1] 263	.....do....................	.....do............	3	40	16.40	250	3,468	490.0	522	6.385	76.7	573.0	24.36	4⅜	28.73	2,222	91.3	34.9	140.0	.00861
[1] 264	.....do....................	Stone dressed.....	2	60	24.65	225	3,120	418.0	459	7.850	53.2	814.0	24.36	4⅝	28.73	1,930	78.3	43.9	131.0	.00543
[1] 276	.....do....................	Same as noble fir No. 18.	2	20	8.20	225	3,120	151.0	198	1.750	86.0	117.0	25.11	4¾	28.88	2,380	94.8	11.5	133.0	.00590
[1] 277	.....do....................	Same surface......	2	40	16.40	225	3,120	310.0	353	4.295	72.2	448.0	25.11	4½	28.88	1,920	76.5	27.3	128.0	.00606
[1] 278	.....do....................	.....do............	2	60	24.65	225	3,120	469.0	530	9.040	52.0	769.0	25.11	4⅞	28.88	2,354	93.8	32.4	127.0	.00609
[1] 279	.....do....................	.....do............	2	80	32.80	225	3,120	542.0	606	11.800	46.0	982.0	25.11	4½	28.88	2,400	95.6	31.0	122.0	.00530
[1] 280	.....do....................	.....do............	3	30	12.32	200	2,774	296.0	361	3.580	82.7	304.0	25.11	4⅝	28.88	2,360	94.0	9.1	72.0	.00867
[1] 281	.....do....................	.....do............	3	30	12.32	200	2,774	312.0	370	3.675	85.0	310.0	25.11	4½	28.88	2,360	94.0	11.4	133.0	.00913
[1] 282	.....do....................	.....do............	3	30	12.32	200	2,774	308.0	364	3.000	103.0	260.0	25.11	4½	28.88	2,300	91.6	19.8	168.0	.00902

[1] Seasoned wood used.

[2] Partially decayed wood used.

Runs 257–282 were run on a coarse-grit stone.

TABLE 6.—*Grinder runs on spruce wood—cooked prior to grinding.*

Grinder run No.	Cooking treatment. Kind of cook.	Cooking treatment. Duration of cook.	Cooking treatment. Gauge pressure.	Stone. Kind of burr.	Stone. Surface of stone.	Number of pockets used.	Pressure on 14-inch cylinder.	Revolutions per minute.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot of wood (bone-dry).	Average diameter of wood.	Moisture in wood.	Pulp bone-dry per 100 cubic feet of solid rossed wood.	Efficiency of conversion.	Screenings bone-dry per 100 cubic feet solid rossed wood.	Average temperature of grinding.	Horsepower divided by pressure × speed.
		Hrs.	*Lbs.*				*Lbs. per sq. in.*				*Tons.*		*Cu. ft.*	*Lbs.*	*Ins.*	*Per cent.*	*Lbs.*	*Per cent.*	*Lbs.*	*° F.*	
[1] 51	Steamed	8	60	Straight, cut 3 to in.; spiral cut, 12 to in.	Same as for tamarack No. 23	3	40	200	326	372	3.130	104.0	340.0	22.96	9⅞	39.08	1,840	80.2	18.47	156.6	0.00719
[1] 57	Boiled [2]	4	60	do	Same as for spruce No. 56	3	40	200	335	394	3.380	99.2	296.0	27.11	5¼	25.31	2,283	84.4	23.60	156.0	.00739
[1] 72	Steamed	8	60	do	Same as for western yellow pine No. 3.	3	40	200	301	358	2.250	133.9	250.0	25.06	6⅛	30.36	1,800	71.9	16.15	166.4	.00664
[1] 73	do	2	60	do	Same as for white birch No. 1	3	40	200	353	415	2.800	126.0	264.0	26.84	5⅝	30.73	2,122	79.0	19.25	164.1	.00777
[1] 77	do	4	60	do	Same as for spruce No. 76	3	20	175	172	212	.784	220.0	79.2	26.06	5¼	31.29	1,980	76.0	12.48	171.0	.00871
[1] 78	do	4	60	do	Same surface	3	40	175	299	349	2.155	138.8	208.5	27.48	6	28.61	2,066	75.2	18.19	158.2	.00755
[1] 79	do	4	60	do	do	3	60	175	373	449	2.935	127.1	292.0	27.14	6⅛	28.83	2,013	74.2	23.90	149.4	.00626
[3] 97	do	6	60	do	Stone dressed	2	20	225	153	189	1.803	84.9	197.8	26.66	6⅝	36.51	1,823	68.4	10.08	131.5	.00605
[3] 98	do	6	60	do	Same surface	2	40	225	230	272	3.365	68.1	352.0	27.19	6	39.66	1,910	70.3	18.32	121.1	.00452
[3] 99	do	6	60	do	do	2	60	225	308	360	4.020	76.7	426.0	27.19	7	39.66	1,883	69.4	27.37	120.2	.00404
[3] 100	do	6	60	do	do	2	80	225	369	401	4.655	79.1	496.0	27.19	6¼	39.66	1,876	69.0	34.00	125.1	.00364
[3] 101	do	6	60	do	do	2	100	225	420	510	4.615	90.9	487.0	27.19	6⅛	39.66	1,896	69.7	45.85	128.4	.00332
[4] 102	do	6	60	do	Stone dressed	3	40	200	280	320	3.075	91.1	376.0	25.06	6¼	44.00	1,636	65.3	18.57	125.0	.00621
[1] 103	do	2	20	do	Same surface	3	40	200	332	382	4.195	79.1	378.0	27.81	6½	26.22	2,219	79.7	12.28	128.7	.00736
[1] 104	do	4	20	do	do	3	40	200	323	393	4.210	76.7	390.0	27.81	6⅜	26.22	2,160	77.6	16.86	137.0	.00716
[1] 105	do	6	20	do	do	3	40	200	327	364	3.995	81.8	422.0	27.81	5¾	26.22	1,892	68.0	10.36	126.1	.00725
[1] 106	do	8	20	do	do	3	40	200	320	382	3.595	89.1	346.0	27.30	5⅝	27.56	2,081	76.3	17.81	137.8	.00710
[1] 107	do	12	20	do	do	3	40	200	323	398	3.565	90.6	344.0	27.30	5⅞	27.56	2,070	75.8	19.93	136.4	.00716
[1] 108	do	2	40	do	do	3	40	200	339	393	3.810	89.0	337.0	26.50	5½	29.88	2,263	85.5	16.53	144.9	.00752
[1] 109	do	4	40	do	do	3	40	200	307	363	3.705	82.9	342.0	26.50	5⅜	29.88	2,170	82.0	21.80	134.0	.00681
[1] 110	do	6	40	do	do	3	40	200	285	342	2.927	97.4	278.0	26.50	5¼	29.88	2,105	79.5	15.80	142.2	.00632
[1] 111	do	8	40	do	do	3	40	200	275	323	3.037	90.6	304.0	26.50	5⅜	29.88	2,000	75.5	12.98	139.5	.00610
[1] 113	do	12	40	do	Same as for spruce No. 112	3	40	200	288	342	2.985	96.5	299.0	26.50	5½	29.88	1,998	75.4	10.40	143.7	.00639
[3] 115	do	2	60	do	Same as for spruce No. 114	3	40	200	294	368	3.260	90.1	314.0	27.19	5⅞	39.66	2,080	76.5	10.96	137.9	.00652
[3] 116	do	4	60	do	Same surface	3	40	200	252	303	2.475	101.9	270.0	25.05	6¼	40.34	1,830	73.2	19.30	140.8	.00559
[3] 117	do	6	60	do	do	3	40	200	271	328	2.540	106.7	295.0	25.05	6	40.34	1,722	68.8	11.13	138.1	.00601
[3] 118	do	8	60	do	do	3	40	200	283	329	2.775	102.0	325.0	25.05	6	40.34	1,710	68.3	14.76	138.6	.00627

[3] 119	...do.......	12	60	.....do..............	.....do........................	3	40	200	277	329	2.805	98.8	336.0	25.05	6⅜	40.34	1,670	66.7	13.10	138.6	.00614
[1] 130	...do.......	4	60	.....do..............	Same as for spruce No. 129....	3	60	225	495	590	5.110	96.7	482.0	28.01	5⅛	29.09	2,124	75.9	45.70	143.6	.00650
[1] 131	...do.......	4	60	.....do..............	Same surface..................	3	40	225	378	435	3.807	99.3	362.0	27.66	4⅝	28.08	2,100	75.9	19.87	145.1	.00746
[1] 132	...do.......	4	60	.....do..............	.....do........................	3	20	225	230	268	1.977	116.3	186.8	27.66	4½	28.08	2,118	76.5	10.55	149.3	.00908
[1] 167	...do.......	6	60	.....do..............	Same as for spruce No. 166.....	2	20	225	143	175	.436	327.0	50.8	26.15	6¼	30.19	1,720	65.9	8.54	150.0	.00564
[1] 168	...do.......	6	60	.....do..............	Same surface..................	2	40	225	234	285	1.470	159.0	153.9	26.15	5	30.19	1,910	73.1	13.0	152.0	.00462
[1] 169	...do.......	6	60	.....do..............	.....do........................	2	60	225	318	362	2.845	111.7	280.0	26.15	5	30.19	2,030	77.6	21.2	132.0	.00417
[1] 170	...do.......	6	60	.....do..............	.....do........................	2	80	225	407	480	3.480	117.0	352.0	26.15	4½	30.19	1,980	75.8	26.05	139.0	.00402
[1] 171	...do.......	6	60	.....do..............	.....do........................	2	100	225	440	517	3.505	125.5	368.0	26.15	4⅞	30.19	1,910	73.0	29.3	133.7	.00348
[1] 172	...do.......	6	60	Diamond point, cut 8 to in.	Stone dressed..................	2	20	225	143	179	.748	191.1	82.6	26.52	4⅞	29.56	1,810	68.2	6.31	153.0	.00565
[1] 173	...do.......	6	60	.....do..............	Same surface..................	2	40	225	240	279	1.975	121.3	203.0	26.52	4⅞	29.56	1,945	73.4	9.5	135.7	.00474
[1] 174	...do.......	6	60	.....do..............	.....do........................	2	60	225	313	376	2.840	110.1	292.0	26.52	4⅜	29.56	1,942	73.3	15.4	138.7	.00411
[1] 175	...do.......	6	60	.....do..............	.....do........................	2	80	225	352	431	3.195	110.0	327.0	26.52	4⅝	29.56	1,953	73.7	24.9	137.0	.00348
[1] 176	...do.......	6	60	.....do..............	.....do........................	2	100	225	393	493	3.445	114.0	336.0	26.52	5	29.56	2,048	77.3	28.2	146.8	.00314
[1] 182	...do.......	6	60	Spiral, cut 6 to in.	Stone dressed..................	2	20	225	167	211	1.170	142.4	128.8	26.85	4⅞	25.96	1,818	67.6	14.78	130.6	.00658
[1] 183	...do.......	6	60	.....do..............	Same surface..................	2	40	225	271	318	2.680	101.0	282.0	26.85	5¾	25.96	1,900	70.7	21.70	131.0	.00535
[1] 184	...do.......	6	60	.....do..............	.....do........................	2	60	225	350	402	3.425	102.2	397.0	26.85	4¾	25.96	1,725	64.2	34.80	107.0	.00460
[1] 185	...do.......	6	60	.....do..............	.....do........................	2	60	225	345	403	4.130	83.5	411.0	26.85	5½	25.96	2,010	74.9	31.8	119.0	.00453
[1] 186	...do.......	6	60	.....do..............	.....do........................	2	80	225	400	460	4.930	81.2	501.0	26.85	4½	25.96	1,968	73.2	50.9	115.0	.00395
[1] 187	...do.......	6	60	.....do..............	.....do........................	2	100	225	452	532	5.250	86.1	541.0	26.85	4¾	25.96	1,940	72.2	60.5	112.0	.00358
[1] 188	...do.......	6	60	.....do..............	.....do........................	2	60	100	163	202	1.591	102.2	166.0	26.65	5	30.50	1,920	72.0	27.10	106.5	.00481
[1] 189	...do.......	6	60	.....do..............	.....do........................	2	60	150	233	272	2.375	98.2	263.0	26.85	5¼	25.96	1,803	67.1	27.5	107.4	.00460
[1] 190	...do.......	6	60	.....do..............	.....do........................	2	60	200	324	369	3.820	84.8	399.0	26.85	5¼	25.96	1,912	71.1	41.1	118.8	.00479
[1] 191	...do.......	6	60	.....do..............	.....do........................	2	60	250	376	435	5.120	73.4	533.0	26.85	4⅞	25.96	1,922	71.5	30.95	107.0	.00445
[1] 192	...do.......	12	60	Straight, cut 8 to in.	Stone dressed..................	3	50	225	324	410	2.510	129.0	287.0	25.14	7	28.70	1,750	69.6	11.9	129.9	.00515
[1] 193	...do.......	10	60	.....do..............	Same surface..................	3	50	225	329	421	2.425	135.7	287.0	25.14	6½	28.70	1,690	67.3	14.53	136.7	.00522
[1] 194	...do.......	8	60	.....do..............	.....do........................	3	50	225	356	445	2.126	167.2	238.0	25.14	6¼	28.70	1,790	71.3	15.20	143.3	.00565
[1] 195	...do.......	6	60	.....do..............	.....do........................	3	50	225	358	441	2.125	168.3	218.0	25.14	5½	34.14	1,942	77.4	14.69	146.7	.00569
[1] 196	...do.......	4	60	.....do..............	.....do........................	3	50	225	353	453	2.052	172.1	247.0	25.14	6⅞	32.30	1,660	66.1	15.81	145.6	.00560
[1] 197	...do.......	2	60	.....do..............	.....do........................	3	50	225	378	466	2.047	184.8	185.0	25.14	6½	34.14	2,212	88.0	14.68	164.9	.00599
[1] 198	...do.......	0	0	.....do..............	.....do........................	3	50	225	451	515	2.475	182.6	238.0	23.74	5	35.13	2,073	87.4	9.55	172.0	.00715
[1] 199	...do.......	12	25	Straight, cut 3 to in.; spiral, cut 12 to in.	Same as for western hemlock No. 14.	3	60	225	348	416	3.495	99.6	321.0	24.85	4½	34.66	2,178	87.5	17.82	112.6	.00460
[1] 200	...do.......	8	25	.....do..............	Same surface..................	3	60	225	363	413	3.455	105.0	320.0	24.85	4⅜	34.66	2,160	86.9	16.33	120.0	.00479
[1] 201	...do.......	6	25	.....do..............	.....do........................	3	60	225	354	400	3.490	101.4	305.0	24.85	4¾	34.66	2,285	92.0	15.46	115.0	.00467
[1] 202	...do.......	2	25	.....do..............	.....do........................	3	60	225	367	423	3.620	101.2	318.0	24.85	4⅞	34.66	2,280	91.6	21.45	129.0	.00484
[1] 203	...do.......	4	25	.....do..............	.....do........................	3	60	225	378	439	4.080	92.6	372.0	24.85	4½	34.66	2,195	88.3	19.98	119.0	.00499
[1] 204	...do.......	0	0	.....do..............	.....do........................	3	60	225	376	434	4.055	92.6	361.0	24.85	4⅝	34.66	2,245	90.4	9.55	129.2	.00496
[1] 205	...do.......	2	75	.....do..............	.....do........................	3	60	225	313	375	3.170	98.8	308.0	24.85	4⅝	34.66	2,060	82.9	20.10	98.6	.00413
[1] 206	...do.......	4	75	.....do..............	.....do........................	3	60	225	063	343	3.230	94.8	316.0	24.85	5¼	34.66	2,045	82.3	23.18	100.0	.00404
[1] 207	...do.......	6	75	.....do..............	.....do........................	3	60	225	315	359	3.100	101.5	312.0	24.85	4⅞	34.66	1,985	79.9	14.46	104.9	.00415
[1] 208	...do.......	8	75	.....do..............	.....do........................	3	60	225	307	360	3.160	97.2	329.0	24.85	4⅞	34.66	1,920	77.2	19.68	101.3	.00405
[1] 209	...do.......	12	75	.....do..............	.....do........................	3	60	225	318	358	3.575	89.0	370.0	24.85	4¼	34.66	1,930	77.6	16.90	94.6	.00420
[1] 211	...do.......	12	25	Spiral, cut 8 to in.; straight, cut 10 to in.	Stone dressed..................	2	60	225	280	318	3.445	81.3	302.0	26.50	6⅝	30.90	2,280	86.0	9.89	130.0	.00370
[1] 212	...do.......	8	25	.....do..............	Same surface..................	2	60	207	280	348	3.390	82.6	302.0	26.50	7⅞	30.90	2,244	84.8	12.10	139.5	.00402
[1] 213	...do.......	6	25	.....do..............	.....do........................	2	60	184	271	324	3.138	86.4	272.0	26.50	6¾	30.90	2,308	87.1	12.40	140.5	.00436
[1] 214	...do.......	4	25	.....do..............	.....do........................	2	60	179	274	334	3.360	81.5	290.0	26.50	7	30.90	2,320	87.5	11.63	140.0	.00455

[1] Seasoned wood used. [2] Boiled in a 0.3 per cent soda-ash solution. [3] Green wood used. [4] Green wood was ground with bark on.

TABLE 6.—*Grinder runs on spruce wood—cooked prior to grinding*—Continued.

Grinder run No.	Cooking treatment. Kind of cook.	Duration of cook.	Gauge pressure.	Stone. Kind of burr.	Surface of stone.	Number of pockets used.	Pressure on 14-inch cylinder.	Revolutions per minute.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot of wood (bone-dry).	Average diameter of wood.	Moisture in wood.	Pulp bone-dry per 100 cubic feet of solid rossed wood.	Efficiency of conversion.	Screenings bone-dry per 100 cubic feet solid rossed wood.	Average temperature of grinding.	Horsepower divided by pressure × speed.
		Hrs.	*Lbs.*				*Lbs. per sq. in.*				*Tons.*		*Cu. ft.*	*Lbs.*	*Ins.*	*Per cent.*	*Lbs.*	*Per cent.*	*Lbs.*	*° F.*	
1 215	Steamed	2	25	Spiral, cut 8 to in.; straight, cut 10 to in.	Same surface	2	60	174	274½	327	3.118	88.1	270.0	26.50	6½	30.90	2,310	87.1	14.16	136.4	0.00469
1 216	do	0	0	do	do	2	60	171	275	332	3.300	83.4	278.0	26.50	7⅝	30.90	2,372	89.5	10.82	144.0	.00477
1 217	do	12	75	do	do	2	60	225	320	361	3.300	97.0	357.0	26.50	7½	30.90	1,848	69.6	12.96	136.4	.00422
1 218	do	8	75	do	do	2	60	219	280	318	2.793	100.2	298.0	26.50	6⅜	30.90	1,872	70.6	14.40	133.1	.00380
1 219	do	6	75	do	do	2	60	214	274	327	2.192	125.0	234.0	26.50	8¼	30.90	1,875	70.7	11.43	140.7	.00381
1 220	do	4	75	do	do	2	60	210	280	342	2.590	108.5	262.0	26.50	8⅜	30.90	1,978	74.5	16.45	136.0	.00396
1 221	do	2	75	do	do	2	60	187	280	367	2.395	117.0	220.0	26.50	7	30.90	2,170	81.9	12.10	140.0	.00445
1 223	do	6	75	do	Stone dressed	2	60	225	277	348	3.130	88.5	321.0	25.20	5¼	34.69	1,952	77.5	18.90	131.0	.00368
1 224	do	6	60	do	Same surface	2	60	207	281	345	3.150	89.2	285.0	25.20	5⅛	34.69	2,205	87.5	27.00	131.0	.00406
1 225	do	6	40	do	do	2	60	200	276	327	3.195	86.6	312.0	25.20	5⅛	34.69	2,040	81.0	14.10	125.0	.00413
1 226	do	6	20	do	do	2	60	179	277	338	3.845	72.0	332.0	25.20	5⅜	34.69	2,315	91.8	17.50	137.0	.00461
1 227	do	0	0	do	do	2	60	156	280	331	3.895	72.0	318.0	25.20	5⅜	34.69	2,450	97.2	4.80	136.0	.00537
1 228	do	3	75	do	do	2	60	216	277	332	3.055	90.7	284.0	25.20	4⅞	34.69	2,150	85.4	19.30	133.0	.00383
1 229	do	3	60	do	do	2	60	204	280	333	3.225	86.8	308.0	25.20	5¾	34.69	2,092	83.0	22.60	135.0	.00410
1 230	do	3	40	do	do	2	60	179	278	328	3.355	82.9	300.0	25.20	5⅞	34.69	2,238	88.7	15.10	136.0	.00463
1 231	do	3	20	do	do	2	60	164	277	335	3.480	79.5	300.0	25.20	5⅜	34.69	2,320	92.0	11.10	141.0	.00504
1 232	do	0	0	do	do	2	60	157	278	328	3.980	69.9	328.0	25.20	5⅜	34.69	2,425	96.4	9.90	133.0	.00529
1 233	do	6	75	Diamond point, cut 6 to in.	Stone dressed	2	60	225	345	404	3.710	93.0	356.0	25.66	5¼	31.12	2,085	81.4	27.6	146.0	.00458
1 234	do	6	60	do	Same surface	2	60	210	348	415	3.540	98.3	334.0	25.66	5	31.12	2,120	82.6	20.4	138.0	.00495
1 235	do	6	40	do	do	2	60	206	344	390	3.510	98.0	323.0	25.66	5⅛	31.12	2,176	84.7	17.5	140.0	.00500
1 236	do	6	20	do	do	2	60	187	344	409	4.150	82.9	364.0	25.66	5⅜	31.12	2,280	88.9	25.2	141.0	.00550
1 237	do	0	0	do	do	2	60	178	339	385	4.090	83.0	343.0	25.66	5	31.12	2,385	93.0	12.0	142.0	.00570
1 238	do	3	75	do	do	2	60	205	347	398	3.710	93.5	362.0	25.66	5¼	31.12	2,048	79.9	20.6	142.0	.00506
1 239	do	3	60	do	do	2	60	192	344	408	4.050	85.0	376.0	25.66	5⅛	31.12	2,155	83.9	27.3	137.0	.00535
1 240	do	3	40	do	do	2	60	191	342	388	4.150	82.5	365.0	25.66	4⅞	31.12	2,278	88.6	21.9	134.0	.00535
1 241	do	3	20	do	do	2	60	188	347	390	4.300	80.7	360.0	25.66	6	31.12	2,395	93.2	23.0	138.0	.00552
1 242	do	0	0	do	do	2	60	176	354	398	4.360	81.2	378.0	25.66	4	31.12	2,310	90.0	15.0	129.0	.00601

[1,2] 265	...do	8	60	Straight, cut 3 to in.; spiral, cut 12 to in.	Stone dressed..................	2	60	225	334	376	5.735	58.3	641.0	24.36	4½	28.73	1,788	73.4	143.0	129.0	.00434
[1] 266	...do.......	6	60	.....do.............	Same surface..................	2	60	217	336	402	5.875	57.3	630.0	24.36	4⅜	28.73	1,867	76.6	119.7	125.0	.00452
[1] 267	...do.......	4	60	.....do.............	.....do........................	2	60	202	336	373	5.840	57.6	622.0	24.36	4½	28.73	1,878	77.1	154.3	125.0	.00486
[1] 268	...do.......	2	60	.....do.............	.....do........................	2	60	191	328	373	6.615	49.6	601.0	24.36	4⅝	28.73	2,200	90.4	53.3	126.0	.00502
[1] 269	...do.......	0	0	.....do.............	.....do........................	2	60	181	339	409	6.910	49.0	605.0	24.36	4¼	28.73	2,280	93.6	55.0	130.0	.00548
[1] 270	...do.......	6	60	.....do.............	.....do........................	2	40	200	261	319	4.050	64.5	421.0	25.11	5	28.88	1,920	76.5	118.2	129.0	.00575
[1] 271	...do.......	6	60	.....do.............	.....do........................	2	60	200	320	374	5.645	56.8	579.0	25.11	5¼	28.88	1,950	77.7	143.8	113.0	.00468
[1] 272	...do.......	6	60	.....do.............	.....do........................	2	80	200	379	430	6.500	58.3	685.0	25.11	5	28.88	1,900	75.7	212.0	126.0	.00417
[1] 273	...do.......	6	40	.....do.............	.....do........................	2	60	189	320	362	5.600	57.4	563.0	25.11	4¾	28.88	1,990	79.4	244.0	126.0	.00495
[1] 274	...do.......	6	20	.....do.............	.....do........................	2	60	171	326	357	5.910	55.1	533.0	25.11	5	28.88	2,220	88.4	193.0	110.0	.00558
[1] 275	...do	0	0	.....do.............	.....do........................	2	60	168	324	357	6.110	53.0	534.0	25.11	5⅜	28.88	2,285	91.1	39.2	119.0	.00564

[1] Seasoned wood used.

[2] Runs 265 to 275, inclusive, were ground on a coarse grit stone.

TABLE 7.—*Quality tests—white spruce.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test. Total.	Mullen test. Per 0.001 inch of thickness.	Mullen test. Per pound.	Mullen test. Horsepower per ton divided by strength factor.	Schopper tests. Breaking length. Crosswise.	Schopper tests. Breaking length. Lengthwise.	Schopper tests. Breaking length. Average.	Schopper tests. Stretch. Crosswise.	Schopper tests. Stretch. Lengthwise.	Schopper tests. Stretch. Average.	Schopper tests. Breaking weight per square millimeter, sectional area.	Schopper tests. Breaking length per horsepower per ton.	Tintometer indications. Red.	Tintometer indications. Green.	Tintometer indications. Blue.	Tintometer indications. Black.
		Per ct.	Lbs.	Inch.	Points.	Points.	Point.		Meters.	Meters.	Meters.	Per ct.	Per ct.	Per ct.	Grams.	Meters.	Parts.	Parts.	Parts.	Parts.
1																				
2	110	80	32.0	0.00387	12.15	3.14	0.380	256.0	2,600	4,000	3,300	3.00	1.40	2.20	1,506	33.9	95	86	78	41
3	62	80	32.0	.0036	16.4	4.55	.513	306.0	3,075	5,300	4,188	2.04	1.22	1.63	2,050	26.7	89	80	73	58
4	75	80	37.0	.0041	19.35	4.72	.523	210.0	3,585	6,040	4,821	1.98	1.04	1.51	2,440	43.8	87	76	66	71
5	42	80	29.0	.0038	11.3	2.97	.390	221.0	2,420	4,640	3,530	1.74	.98	1.36	1,462	40.8	89	78	68	65
6	11	80	40.0	.0047	21.4	4.55	.535	351.0	2,500	5,440	3,970	1.18	1.10	1.14	1,936	21.2	90	80	70	60
7	22	79	33.0	.0038	15.7	4.13	.476	229.0	3,120	6,210	4,665	1.76	1.06	1.41	2,130	42.8	88	79	69	64
8	56	80	34.0	.0043	14.05	3.27	.413	221.0	2,673	4,780	3,727	1.66	1.10	1.38	1,590	40.9	87	77	64	72
9	51	80	33.0	.00384	17.95	4.72	.544	323.0	3,344	5,690	4,517	2.86	1.58	2.22	2,350	25.7	82	71	61	86
9-1	16	80	35.0	.0046	17.50	3.74	.493	189.0	3,040	5,410	4,225	1.58	.98	1.28	1.272	45.2	96	79	75	50
10	72	80	33.0	.00394	14.15	3.60	.429	174.0	2,973	5,358	4,166	1.40	1.04	1.22	1,975	55.9	81	73	66	80
11	45	80	34.0	.0042	12.35	2.94	.363	180.0	2,123	4,335	3,229	2.92	1.30	2.11	1,360	49.3	91	78	70	61
12	92	80	34.0	.00417	15.65	3.75	.460	163.0	3,180	5,320	4,250	1.78	1.22	1.50	1,895	56.6	97	85	76	42
13	20	80	34.0	.0040	13.00	3.25	.382	176.0	2,655	5,030	3,843	1.98	1.10	1.54	1,680	57.3	90	79	66	65
14	28	80	34.0	.0047	13.00	2.77	.382	170.0	2,065	4,325	3,195	1.94	1.12	1.53	1,330	49.2	90	79	69	62
14	29	80	32.0	.00414	11.45	2.77	.358	181.0	2,228	4,020	3,124	1.74	1.02	1.38	1,240	48.2	90	80	74	56
15	61	80	30.0	.00343	16.55	4.83	.552	231.0	3,865	5,750	4,808	2.22	1.10	1.66	2,340	37.7	84	72	66	78
16	19	80	38.0	.0043	17.45	4.06	.459	192.0	3,098	5,960	4,529	2.16	1.26	1.71	2,114	51.3	85	75	64	76
17	48	80	33.0	.00298	13.40	4.47	.406	196.0	2,395	3,795	3,095	2.40	.98	1.64	1,940	38.8	88	73	65	74
18	73	80	29.0	.0033	14.50	4.40	.500	224.0	3,085	5,850	4,468	1.76	1.16	1.46	2,119	39.9	86	77	70	67
19	91	80	35.0	.00397	16.35	4.12	.467	192.0	3,350	5,360	4,355	2.00	1.20	1.60	2.085	48.5	95	82	75	48
20	43	80	31.0	.0039	13.90	3.56	.448	183.0	2,865	4,855	3,860	1.94	1.00	1.47	1,613	47.1	92	82	71	55
21	21	80	44.0	.0045	25.6	5.69	.582	249.0	3,384	6,680	5,032	2.56	1.48	2.02	2,700	34.8	87	78	67	68
22	77	80	33.0	.00354	17.15	4.85	.520	273.0	3,400	5,850	4,625	2.02	1.24	1.63	2,350	32.6	82	69	61	88
23	79	80	33.0	.00355	18.70	5.27	.567	236.0	3,570	5,910	4,740	2.46	1.24	1 85	2,420	35.3	84	75	70	71
24	67	80	33.0	.0037	16.75	4.53	.508	196.0	3,165	5,430	4,298	2.22	1.32	1.77	2,010	43.1	86	74	67	73
25	59	80	31.0	.00373	15.9	4.30	.513	174.0	3,045	4,840	3,943	2.18	1.18	1.68	1,850	44.1	78	66	58	98
26	50	80	36.0	.0041	17.9	4.36	.497	178.0	3,000	5,650	4,325	2.60	1.60	2.10	2,150	48.7	88	75	64	73
27	8	80	33.0	.0042	13.85	3.30	.420	194.0	2,445	5,018	3,732	1.24	1.05	1.15	1,656	45.8	85	71	66	78
28	95	80	35.0	.0039	18.2	4.67	.520	229.0	2,965	5,200	3,833	2.00	1.08	1.54	2,185	32.1	95	79	71	55
29	96	80	32.0	.00365	16.1	4.41	.503	240.0	3,570	5,480	4,525	2.04	1.12	1.58	2,170	37.6	88	79	71	62
29-1	64	80	31.0	.0036	15.15	4.21	.489	261.0	3,195	5,020	4,108	2.22	1.14	1.68	1,975	32.2	85	76	68	71

30........	58	80	31.0	.00364	15.00	4.17	.484	191.0	3,295	5,400	4,348	2.12	1.14	1.63	1,914	47.0	87	78	67	68
31........	26	80	31.0	.0035	13.25	3.79	.427	234.0	3,050	5,480	4,255	1.72	1.08	1.40	1,928	42.5	91	80	72	57
32........	66	80	31.0	.0041	8.5	2.07	.274	220.0	2,085	3,745	2,915	1.12	.94	1.03	1,220	48.2	87	78	71	64
33........	24	80	33.0	.0045	10.0	2.22	.303	188.0	2,180	4,230	3,205	1.36	.88	1.12	1,254	56.2	87	77	69	67
34........	17	80	33.0	.0047	10.75	2.29	.326	186.0	2,140	4,000	3,070	1.20	.88	1.04	1,260	50.6	90	76	66	68
35........	23	80	33.0	.0044	11.7	2.66	.354	183.5	2,282	4,600	3,441	1.48	.96	1.22	1,365	53.1	83	72	61	84
36........	18	80	32.0	.0041	11.45	2.73	.358	181.0	2,294	4,935	3,615	1.48	1.00	1.24	1,500	55.8	90	79	70	61
37........	53	80	34.0	.0043	12.35	2.87	.363	174.0	2,700	4,060	3,380	2,04	1.12	1.58	1,414	53.5	86	74	66	74
37........	55	80	34.0	.00436	12.35	2.83	.363	174.0	2,560	3,970	3,265	1.96	1.08	1.52	1,340	51.7	88	76	64	72
38........	54	80	34.0	.0044	11.60	2.64	.341	197.0	2,330	3,570	2,950	1,78	1.08	1.43	1,236	44.0	83	70	61	86
39........	69	79	30.0	.00363	9.95	2.74	.331	221.0	2,500	4,725	3,613	1.04	.98	1.01	1,570	49.5	81	70	62	87
40........	14	80	33.0	.0044	13.80	3.14	.330	232.0	2,750	4,635	3,693	1.44	.98	1.21	1,615	48.22	89	74	65	72
41........	74	80	30.0	.0039	12.10	3.10	.403	181.0	2,805	4,950	3,878	1.46	1.08	1.27	1,610	53.1	84	71	63	82
42........	39	80	31.0	.0035	13.70	3.91	.442	229.0	2,773	5,280	4,026	2.14	1.12	1.63	2,014	39.8	87	76	72	65
43........	47	80	32.0	.0037	13.8	3.73	.431	235.0	2,810	5,210	4,010	2.14	1.32	1.73	1,910	39.6	88	80	70	62
44........	25	80	31.0	.0036	11.9	3.30	.384	224.0	2,650	5,170	3,910	1.40	1.00	1.20	1,695	45.5	84	72	61	83
45........	52	80	35.0	.0037	15.95	4.31	.455	353.0	3,055	4,950	4,003	2.72	1.36	2.04	2,010	25.0	79	69	59	93
46........	40	80	30.0	.0038	14.45	3.80	.482	197.0	5,280	5,135	3,858	2.54	1.22	1.88	1,710	40.7	87	79	70	64
47........	44	80	32.0	.0040	13.6	3.40	.425	188.0	2,714	4,620	3,517	2.54	1.54	2.04	1,545	44.0	87	75	66	72
48........	60	80	32.0	.0036	14.6	4.05	.456	288.0	3,455	5,415	4,435	2.02	1.00	1.51	2,200	33.8	80	70	61	89
49........	49	80	32.0	.00356	14.8	4.11	.462	246.0	3,014	5,280	4,147	2.14	1.28	1.71	1,940	36.5	84	73	68	75
50........	41	80	33.0	.0040	14.7	3.68	.444	210.0	2,890	5,300	4,095	1.72	1.06	1.39	1,840	44.0	86	79	69	66
51........	85	80	36.0	.0037	20.5	5.55	.569	183.0	3,460	5.400	4,430	2.68	1.16	1.92	2,355	42.6	58	40	36	166
52........	97	80	35.0	.00295	17.35	5.88	.495	366.0	3,525	4,805	4,165	1.92	.84	1.38	2,880	23.0	83	76	68	73
53........	63	80	29.0	.00336	11.25	3.35	.388	270.0	2,925	5,155	4,040	1.84	1.14	1.49	1,810	38.6	89	79	69	63
54........	82	80	35.0	.00423	13.30	3.14	.380	180.0	2,985	4,580	3,783	1.84	1.16	1.50	1,728	55.5	83	73	69	75
55........	68	80	29.0	.0039	8.9	2.28	.306	195.0	2,445	4,260	3,353	1.50	1.02	1.26	1,395	56.2	88	78	71	63
56........	71	80	31.0	.0048	10.5	2.48	.326	175.0	2,300	4,060	3.180	1.18	.92	1.05	1,394	55.8	86	74	66	74
57........	80	80	35.0	.0041	16.45	4.01	.470	211.0	3,245	5,350	4,298	2.26	1.18	1.72	1,934	43.3	82	68	63	87
58........	83	80	32.0	.00417	11.45	2.74	.358	173.0	2,715	4,385	3,550	1.44	1.00	1.22	1,517	57.2	87	75	68	70
59........																				
60........	86	80	30.0	.0036	13.85	3.85	.461	199.5	3,110	5,190	4,150	1.82	1.20	1.51	2,000	45.1	91	81	72	56
61........	87	80	33.0	.00375	15.95	4.25	.483	189.0	3,110	5,000	4,055	2.20	1.36	1.78	1,953	44.3	91	79	74	56
62........	81	80	34.0	.00416	14.05	3.38	.413	210.0	3,040	4,865	3,953	2.04	1.18	1.61	1,775	45.5	91	78	69	62
63........	78	80	32.0	.0040	12.15	3.04	.380	215.0	2,910	5,040	3,975	1.52	1.10	1.31	1,712	48.6	85	76	67	72
64........	76	80	29.0	.00365	11.95	3.28	.412	191.0	2,760	4,635	3,697	1.60	1.02	1.31	1,640	47.0	88	76	67	69
65........	6	80	33.0	.0040	11.40	2.85	.345	233.0	2,445	4,829	3,637	1.63	1.01	1.32	1,569	45.1	87	75	66	72
66........	57	80	33.0	.00425	14.05	3.31	.426	194.5	2,910	4,635	3,773	2.00	1.10	1.55	1,640	45.5	84	72	62	82
67........	4	80	35.0	.0052	12.35	2.38	.353	211.0	2,155	4,218	3,187	1.35	1.02	1.19	1,395	42.8	86	76	66	73
68........	13	80	34.0	.0047	14.75	3.14	.434	188.5	2,750	4,840	3,795	1.72	1.06	1.39	1,610	46.4	89	79	70	62
69........	12	80	32.0	.0043	12.8	2.98	.400	171.5	2,485	4,450	3,467	1.58	.96	1.27	1,510	48.3	92	83	73	52
70........	3	80	32.0	.0042	9.2	2.18	.288	219.0	2,053	4,095	3,074	1.26	.95	1.11	1,203	48.8	84	70	62	84
71........	10	80	34.0	.0046	11.15	2.42	.328	185.5	2,045	4,150	3,088	1.64	.98	1.31	1,310	50.8	84	76	74	66
72........	166	80	37.0	.00354	18.30	5.169	.4946	271.0	3,050	5,206	4,128	2.08	1.18	1.63	2,368	30.8	46	31	24	199
73........	170	80	33.0	.00458	19.00	4.150	.576	218.0	3,000	3,780	3,890	2.42	1.26	1.84	1.940	30.9	57	45	39	159
74........	175	80	32.0	.00369	10.15	2.750	.3170	283.0	1,985	3,705	2,845	2.00	1.10	1.55	1,421	31.7	68	61	54	117
75........	176	80	34.0	.00374	15.00	4.01	.4415	258.0	2,898	4,852	3,875	2.30	1.30	1.80	1,982	34.1	68	66	56	115
76........	177	80	34.0	.00357	17.25	4.83	.5075	371.0	2,965	5,635	4,300	2.14	1.36	1.75	2,235	22.8	67	58	55	120
77........	171	80	35.0	.00348	17.50	5.030	.500	440.0	3,100	5,430	4,265	2.56	1.54	2.05	3.240	19.4	45	32	27	196
78........	167	80	36.0	.00372	19.90	5.350	.5532	251.0	3,408	5,424	4,416	2.34	1.20	1.77	2,425	31.8	63	44	38	155

TABLE 7.—*Quality tests—white spruce*—Continued.

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test. Total.	Mullen test. Per 0.001 inch of thickness.	Mullen test. Per pound.	Mullen test. Horsepower per ton divided by strength factor.	Schopper tests. Breaking length. Crosswise.	Schopper tests. Breaking length. Lengthwise.	Schopper tests. Breaking length. Average.	Schopper tests. Stretch. Crosswise.	Schopper tests. Stretch. Lengthwise.	Schopper tests. Stretch. Average.	Schopper tests. Breaking weight per square millimeter, sectional area.	Schopper tests. Breaking length per horsepower per ton.	Tintometer indications. Red.	Tintometer indications. Green.	Tintometer indications. Blue.	Tintometer indications. Black.
		Per ct.	*Lbs.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
79	192	80	33.0	0.00349	17.70	5.070	0.5364	237.0	3,520	6,744	5,132	1.84	1.08	1.46	2,801	40.3	53	34	27	186
80	190	80	31.0	.00326	15.85	4.86	.5112	559.0	3,688	7,460	5,574	1.80	1.18	1.49	3,002	19.5	76	70	64	90
81	191	80	31.0	.00351	13.90	3.96	.4484	295.0	3,459	6,631	5,045	1.94	1.06	1.50	2,439	38.1	97	85	70	48
82	172	80	35.0	.00408	14.00	3.43	.405	242.0	2,475	4,100	3,288	2.34	1.32	1.83	1,580	33.6	67	55	48	130
83	184	80	31.0	.00367	11.70	3.19	.3775	261.0	2,995	5,100	4,047	1.72	1.04	1.38	1,891	41.0	75	67	61	97
84	183	80	34.0	.00414	15.54	3.73	.4545	258.0	2,840	5,270	4,055	1.74	1.10	1.42	1,893	34.6	78	65	62	95
85	169	80	35.0	.00429	14.20	3.312	.4060	228.0	3,176	4,826	4,001	1.90	1.04	1.47	1,958	43.1	87	76	69	68
86	178	80	34.0	.00418	14.10	3.37	.4100	216.0	2,890	4,850	3,870	1.72	.98	1.35	1,725	43.7	75	65	60	100
87	179	80	34.0	.00399	15.50	3.89	.4565	265.0	3,095	5,685	4,390	1.78	1.16	1.43	2,140	36.2	86	78	71	65
88	163	80	30.0	.00367	11.80	3,217	.3935	290.0	3.830	4,688	3,759	2.06	1.22	1.64	1,748	32.9	84	74	71	71
	180	80	35.0	.00400	14.25	3.56	.4070	281.0	2,883	4,610	3,746	1.82	1.18	1.50	1,803	32.8	92	81	73	54
89	181	80	32.0	.00394	10.65	2.70	.3200	268.0	2,578	4,460	3,519	1.44	.92	1.18	1,637	41.0	85	72	68	75
90	182	80	32.0	.00417	11.25	2.70	.3517	224.0	2,700	4,228	3,464	1.54	.82	1.18	1,508	44.1	87	78	69	66
91	198	80	30.0	.00361	12.35	3.42	.4117	283.0	2,862	5,722	4,292	1.58	1.04	1.31	1,743	36.9	80	71	68	81
(1)																				
97	145	80	34.0	.00363	19.20	5.292	.5650	150.0	2,890	6,012	4,451	2.42	1.06	1.74	2,293	52.5	61	41	32	166
98	146	80	34.0	.00349	17.30	4.957	.5088	134.0	2,832	5,694	4,263	2.56	1.34	1.95	2,238	62.6	54	35	29	182
99	193	80	30.0	.00318	13.15	4.135	.4385	175.0	2,881	6,287	4,584	1.88	1.02	1.45	2,421	59.7	65	43	35	157
100	165	80	33.0	.00347	16.25	4.684	.4926	161.0	2,715	5,345	4,030	2.50	1.32	1.91	2,117	51.0	54	37	30	179
101	196	80	31.0	.00337	15.20	4.51	.4905	185.0	2,630	5,538	4,084	1.98	1.14	1.56	2,072	45.0	55	38	31	176
102	186	80	33.0	.00338	16.15	4.780	.4895	186.0	3,114	5,732	4,423	1.80	.96	1.38	2,350	48.5	43	30	22	205
103	158	80	33.0	.00417	12.40	2.974	.3757	211.0	2,863	5,107	3,985	1.94	1.20	1.57	1,801	50.3	78	64	57	101
104	159	80	34.0	.00350	16.50	4.715	.4851	158.0	3,392	5,760	4,576	2.20	1.28	1.74	2,137	59.7	76	64	57	103
105	187	80	32.0	.00386	16.50	4.280	.5160	158.0	3,575	5,945	4,760	1.76	.92	1.34	2,339	58.3	74	59	50	117
106	195	80	30.0	.00353	14.85	4.21	.495	180.0	2,901	5,891	4,396	2.16	1.00	1.59	2,060	49.4	72	58	49	121
107	194	80	33.2	.00375	17.55	4.68	.529	171.0	3,395	6,328	4,860	2.20	.98	1.59	2,455	53.6	68	53	44	135
108	135	80	31.0	.00386	13.95	3.616	.4536	196.0	3,048	5,460	4,254	2.32	1.18	1.75	1,942	47.8	78	62	53	107
109	136	80	33.0	.00375	17.35	4.630	.5258	157.5	3,155	5,900	4,528	2.48	1.24	1.86	2,203	54.6	65	48	41	146
110	139	80	34.0	.003735	21.30	5.703	.6266	155.0	3,200	6,176	4,688	2.30	1.32	1.81	2,473	48.1	59	42	36	163
111	138	80	34.0	.003645	20.45	5.612	.6015	150.8	3,343	6,620	4,970	2.38	1.26	1.82	2,590	54.9	54	38	30	178
111	144	80	32.0	.0032	18.50	5.78	.5781	157.0	3,270	6,100	4,685	2.18	1.22	1.70	2,490	51.6	57	40	30	173
112	142	80	30.0	.00393	11.50	2.928	.3834	197.0	2,731	4,711	3,721	1.62	.98	1.30	1,580	49.3	88	74	67	71

113	148	80	32.0	.00328	18.15	5.536	.5674	170.0	2,860	4,870	3,865	2.42	1.36	1.89	2,130	40.0	54	34	27	185
114	149	80	31.0	.00398	10.25	2.578	.3307	223.0	2,362	4,066	3,214	1.74	1.08	1.41	1,430	43.5	85	76	65	74
115	151	80	33.0	.00398	14.00	3.518	.4241	213.0	3,074	5,510	4,292	2.12	1.04	1.58	1,950	47.5	71	53	47	129
116	150	80	31.0	.00341	17.15	5.030	.5500	185.0	2,774	5,874	4,324	2.54	1.12	1.83	2,236	42.5	63	48	41	148
117	185	80	31.0	.00337	16.95	5.030	.5470	195.0	2,902	5,995	4,448	1.86	1.00	1.43	2,379	41.7	51	33	25	191
118	155	80	32.0	.00337	14.30	4.245	.4470	228.0	2,826	5,010	3,918	2.84	1.04	1.94	2,158	38.4	51	32	27	190
119	156	80	32.0	.00323	14.15	4.380	.4430	223.0	2,768	4,748	3,758	3.12	1.02	2.07	2,122	38.0	42	26	20	212
120	153	80	31.0	.00422	8.35	1.979	.2694	216.0	2,572	3,910	3,241	1.74	.92	1.33	1,315	55.6	80	70	61	89
121	152	80	33.0	.00429	12.20	2.843	.3698	178.0	2,870	4,722	3,796	1.44	1.00	1.22	1,731	57.7	85	74	67	74
122	173	80	34.0	.00408	14.25	3.50	.419	212.0	2,580	4,565	3,568	2.44	1.20	1.82	1,590	40.1	65	56	52	127
123	157	80	34.0	.00416	12.65	3.040	.3720	234.0	3,064	4,442	3,753	1.88	1.06	1.47	1,748	43.1	89	78	74	59
124	134	80	32.0	.00386	12.45	3.225	.3890	204.0	2,716	4,765	3,740	1.74	1.20	1.47	1,701	47.0	88	82	72	58
125	141	80	31.0	.00365	14.35	3.932	.4630	207.0	3,288	5,460	4,374	2.22	1.36	1.79	2,080	45.8	93	82	76	49
126	131	80	32.0	.003515	15.35	4.369	.4796	284.0	3,172	5,185	4,178	2.96	1.38	2.17	2,078	30.7	91	81	73	55
127	133	80	33.0	.0043	13.775	3.204	.4175	196.0	2,574	4,212	3,393	2.68	1.38	2.03	1,672	41.5	89	75	69	67
128	188	80	32.4	.00373	15.10	4.05	.4660	199.0	3,257	5,585	4,421	1.84	.96	1.40	2,101	47.5	88	72	68	72
129	154	80	31.0	.00334	16.40	4.910	.5290	288.0	3,810	6,348	5,079	2.58	1.22	1.90	2,448	33.3	79	69	57	95
130	137	80	34.0	.00352	19.40	5.514	.5709	169.5	3,152	6,072	4,612	2.38	1.14	1.76	2,334	47.6	61	39	31	169
131	124	80	30.0	.0031	19.90	6.41	.663	150.0	2,684	5,350	4,017	1.90	1.36	1.63	2,195	40.5	77	57	49	117
132	125	80	33.0	.00332	22.3	6.72	.675	173.0	2,876	5,552	4,214	2.36	1.42	1.89	2,224	36.2	63	46	39	152
133	126	80	34.0	.00405	15.1	3.73	.444	196.0	2,958	4,662	3,810	2.26	1.38	1.82	1,815	43.8	94	83	74	49
134	189	80	31.0	.00379	11.90	3.14	.3839	255.0	3,152	5,712	4,432	1.68	1.06	1.37	2,068	45.3	83	72	66	79
135	140	80	30.0	.003755	10.55	2.810	.3518	199.0	2,700	4,591	3,645	1.58	1.00	1.29	1,596	52.3	89	79	69	63
136	129	80	34.0	.004555	13.35	2.93	.3928	183.0	2,466	3,958	3,212	2.92	1.18	2.05	1,437	44.5	87	74	68	71
137	127	80	32.0	.00378	16.85	4.46	.5267	244.0	3,600	6,004	4,802	1.96	1.12	1.54	2,526	37.4	84	74	65	77
138	121	80	31.0	.00359	15.25	4.25	.492	200.0	3,255	4,920	4,088	2.98	1.34	2.16	1,952	41.5	86	73	67	74
139	123	80	33.0	.00409	16.95	4.15	.514	155.0	2,962	4,776	3,869	2.74	1.36	2.05	1,830	48.6	87	76	69	68
140	143	80	31.0	.00356	15.00	4.212	.4840	263.0	3,810	5,840	4,825	2.40	1.12	1.76	2,253	38.0	87	76	66	71
141	130	80	32.0	.004045	15.25	3.77	.4766	194.0	2,740	4,590	3,665	2.98	1.40	2.19	1,756	39.6	80	72	67	81
142	132	80	32.0	.0042	11.80	2.809	.3689	218.0	2,452	3,968	3,210	2.44	1.30	1.87	1,495	39.9	89	78	72	61
143	122	80	33.0	.00426	14.8	3.47	.448	186.0	2,805	4,380	3,593	2.34	1.32	1.83	1,608	43.1	86	76	68	70
144	118	80	31.0	.00414	14.05	3.54	.4725	178.0	2,712	4,350	3,531	2.44	1.40	1.92	1,660	41.9	87	76	72	65
145	128	80	33.0	.004185	13.175	3.149	.3993	198.0	2,831	4,981	3,906	1.90	1.10	1.50	1,605	49.4	88	79	70	63
146	168	80	31.0	.00375	12.10	3.228	.3902	246.0	3,086	4,716	3,901	1.60	1.04	1.32	1,805	40.5	83	70	64	83
147	160	80	35.0	.00407	14.65	3.599	.4187	210.0	3,266	4,680	3,973	2.84	1.22	2.03	1,917	45.0	85	76	68	71
148	164	80	32.0	.00405	12.50	3.087	.3906	220.0	2,728	4,860	3,794	2.14	1.26	1.70	1,846	44.2	83	72	65	80
149	174	80	33.0	.00350	11.00	3.140	.3375	302.0	2,658	4,628	3,643	2.58	1.36	1.97	1,730	35.8	66	56	50	128
150	161	80	32.0	.00398	12.35	3.104	.3859	254.0	3,064	4,554	3,809	2.20	1.10	1.65	1,848	38.9	80	69	64	87
151	162	80	34.0	.00418	14.70	3.518	.4326	217.0	3,162	4,818	3,990	2.40	1.16	1.78	1,944	42.5	84	72	68	76
152	197	80	30.4	.00355	15.10	4.25	.4965	345.0	3,401	6,259	4,830	1.66	1.04	1.35	2,305	28.2	89	77	73	61
154	405	80	34.0	.0044	15.0	3.4	.44	228.0	2,680	4,480	3,580	2.12	1.00	1.56	1,570	35.6	72	62	56	110
155	374	83	35.0	.0035	17.9	5.1	.51	393.0	3,280	6,050	4,660	2.66	1.58	2.12	2,310	23.2	77	66	58	99
156	355	80	36.0	.0039	15.4	4.0	.43	486.0	3,070	5,960	4,520	2.08	1.44	1.76	2,160	21.6	75	63	54	108
157	357	80	34.0	.0038	13.7	3.6	.40	332.0	3,130	5,500	4,320	1.92	1.18	1.55	2,060	32.5	80	68	60	92
158	358	80	33.0	.0038	12.9	3.4	.39	292.0	3,100	5,500	4,300	2.10	1.22	1.66	1,880	37.8	71	61	53	115
159	244	80	32.0	.0028	14.2	5.1	.44	267.0	2,740	4,570	3,660	2.02	1.34	1.68	2,350	31.1	74	67	62	97
160	243	80	31.0	.0032	16.4	5.2	.53	258.0	3,420	5,250	4,340	2.76	1.28	2.02	2,360	31.8	72	64	60	104
161	245	80	32.0	.0033	17.6	5.4	.56	265.0	3,360	5,720	4,540	2.72	1.52	2.12	2,240	30.6	77	69	63	91

[1] 92 to 96, inclusive, qualitative grinder runs; no production data.

TABLE 7.—*Quality tests—white spruce*—Continued.

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 inch of thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length. Crosswise.	Breaking length. Lengthwise.	Breaking length. Average.	Stretch. Crosswise.	Stretch. Lengthwise.	Stretch. Average.	Breaking weight per square millimeter, sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	*Lbs.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
162	247	80	30.0	0.0031	16.2	5.3	0.55	238.0	3,270	5,340	4,300	2.46	1.40	1.93	2,320	32.9	75	66	61	98
163	248	80	37.0	.0037	20.4	5.5	.55	218.0	3,520	5,640	4,580	2.54	1.24	1.89	2,280	38.2	78	71	64	87
164	356	80	41.0	.0048	18.4	3.8	.45	294.0	2,980	5,740	4,360	1.92	1.26	1.59	2,210	33.0	77	67	60	96
165	359	80	31.0	.0035	16.8	4.8	.54	253.0	3,260	6,090	4,680	1.98	1.26	1.62	2,190	34.2	72	62	55	111
166	246	80	28.0	.0031	14.8	4.8	.53	220.0	3,130	5,760	4,440	2.46	1.38	1.92	2,040	38.1	72	65	59	104
167	199	100	36.6	.00292	21.15	7.24	.578	566.0	3,575	7,199	5,387	1.98	1.02	1.50	3,749	16.5	44	26	20	210
168	200	100	38.4	.00329	22.7	6.90	.591	269.0	3,340	5,750	4,545	1.78	.84	1.31	3,000	28.6	42	26	18	214
169	201	100	36.4	.00302	23.4	7.73	.643	174.0	2,871	6,325	4,598	1.78	1.00	1.39	3,014	41.1	38	22	17	223
170	202	100	37.0	.00317	17.25	5.44	.4665	250.0	3,679	6,209	4,944	1.58	.90	1.24	3,119	42.2	39	23	18	220
171	203	100	35.0	.00286	13.7	4.80	.3915	321.0	3,366	6,495	4,930	1.40	.86	1.13	3,234	39.2	40	22	17	221
172	204	100	41.0	.00314	20.5	6.53	.500	382.0	3,623	6,345	4,984	1.42	.90	1.16	3,550	26.0	33	19	13	235
173	205	100	43.0	.00348	22.8	6.56	.530	229.0	3,600	7,140	5,370	1.82	1.02	1.42	3,630	44.3	35	19	14	232
174	206	100	33.6	.00281	18.15	6.45	.5401	204.0	3,324	6,972	5,148	1.46	.98	1.22	3,325	46.7	41	23	17	219
175	207	100	35.0	.00290	21.3	7.35	.609	181.0	3,546	6,495	5,020	1.80	.90	1.35	3,310	45.6	42	24	17	217
176	209	100	39.4	.00323	26.65	8.25	.6765	168.0	3,620	6,255	4,938	2.98	1.08	2.03	3,260	43.3	46	30	23	201
177	226	80	31.0	.0032	17.9	5.6	.57	363.0	3,390	6,560	4,980	2.00	1.24	1.62	2,580	24.0	75	65	60	100
178	229	80	34.0	.0038	17.3	4.6	.51	245.0	3,080	5,440	4,260	2.12	1.26	1.69	2,070	34.1	81	74	68	77
179	228	80	32.0	.0036	15.9	4.4	.50	189.0	3,080	5,600	4,340	2.00	1.26	1.63	2,000	45.9	78	68	62	92
180	227	80	32.0	.0036	15.3	4.2	.48	182.0	3,280	5,800	4,540	2.18	1.30	1.74	2,090	51.9	74	66	60	100
181	230	80	37.0	.0039	12.2	3.1	.38	199.0	2,630	4,370	3,500	1.72	1.08	1.40	1,540	46.4	81	73	68	78
182	210	100	43.0	.0034	27.0	7.95	.63	226.0	3,880	6,740	5,310	3.04	1.08	2.06	3,630	37.3	41	25	18	216
183	208	100	35.0	.00311	25.25	8.12	.7215	140.0	3,105	6,523	4,814	1.92	1.22	1.57	2,920	47.7	47	29	20	204
184	291	100	38.0	.0035	27.8	8.0	.72	142.0	3,450	5,780	4,620	2.68	1.42	2.05	2,810	45.2	46	29	21	204
85	292	100	42.0	.0040	24.4	6.9	.64	130.0	3,150	6,130	4,640	3.08	1.98	2.53	2,900	55.5	48	32	24	196
186	259	100	48.0	.0044	32.8	7.45	.68	119.0	3,220	6,190	4,700	3.38	1.38	2.38	2,880	57.9	46	29	21	204
187	296	100	44.0	.0038	28.0	7.3	.64	134.0	2,940	5,120	4,030	2.64	1.34	1.99	2,560	46.8	42	26	19	213
188	258	100	47.0	.0040	33.2	8.3	.70	146.0	2,980	6,670	4,820	2.54	1.42	1.98	3,020	47.1	46	29	21	204
189	381	100	49.0	.0043	37.4	8.7	.76	129.0	3,660	7,030	5,340	3.32	1.22	2.27	3,410	54.2	44	27	20	209
190	384	100	53.0	.0046	36.6	8.0	.69	123.0	3,540	6,680	5,110	2.66	1.10	1.88	3,310	60.3	45	27	19	209
191	382	100	44.0	.0036	28.0	7.8	.64	115.0	3,510	6,370	4,940	2.94	1.06	2.00	3,110	67.4	43	26	17	214
192	290	100	49.0	.0041	26.8	6.5	.55	234.0	3,100	5,280	4,190	2.62	1.34	1.98	2,880	32.4	41	24	17	218
193	268	100	37.0	.0030	20.0	6.6	.54	251.0	3,020	6,760	4,890	2.44	1.54	1.99	3,100	36.0	41	24	17	218

194	293	100	44.0	.0036	27.6	7.7	.63	266.0	3,180	6,270	4,720	3.50	1.92	2.71	3,250	28.2	42	25	18	215
195	266	100	41.0	.0033	23.8	7.2	.58	290.0	3,580	6,630	5,100	2.04	1.32	1.68	3,370	30.3	50	33	25	192
196	267	100	39.0	.0031	21.0	6.8	.54	319.0	3,360	6,550	4,960	2.14	1.32	1.73	3,350	28.8	44	27	19	210
197	385	100	40.0	.0934	26.6	7.8	.66	280.0	4,410	7,130	5,770	2.04	1.06	1.55	3,760	31.3	59	41	34	166
198	375	100	35.0	.0036	17.3	4.8	.49	372.0	3,260	6,080	4,670	2.42	1.72	2.07	2,290	25.6	75	66	57	102
199	318	100	38.0	.0035	20.8	5.9	.54	185.0	2,830	6,790	4,810	1.68	1.62	1.65	2,860	48.3	55	38	27	180
200	311	100	42.0	.0037	27.2	6.5	.58	181.0	3,210	6,730	4,970	2.24	1.38	1.81	3,160	47.4	59	50	33	158
201	317	100	42.0	.0043	21.6	5.0	.51	199.0	2,600	5,610	4,100	1.38	1.38	1.38	2,200	40.4	69	55	45	131
202	315	100	40.0	.0042	19.7	4.7	.50	202.0	3,090	4,880	3,990	1.98	1.32	1.65	2,150	39.4	72	61	52	115
203	316	100	36.0	.0039	16.8	4.3	.47	197.0	3,340	5,120	4,230	1.98	1.34	1.66	2,040	45.6	61	49	42	148
204	336	80	38.0	.0043	15.7	3.6	.41	226.0	3,030	4,780	3,900	2.24	1.32	1.78	1,850	42.1	82	71	64	83
205	309	100	38.0	.0035	19.8	5.6	.52	190.0	3,010	6,380	4,700	1.76	1.42	1.59	2,780	47.6	66	46	37	151
206	307	100	38.0	.0033	19.0	5.8	.50	190.0	2,230	6,140	4,180	1.10	1.36	1.23	2,730	44.1	46	27	20	207
207	304	100	44.0	.0038	27.8	7.4	.63	161.0	3,100	6,160	4,630	3.04	1.44	2.24	3,120	45.6	37	19	11	233
208	303	100	45.0	.0039	30.2	7.7	.67	145.0	2,700	5,460	4,080	2.58	1.52	2.05	2,660	42.0	34	18	12	236
209	308	100	35.0	.0040	23.1	5.8	.66	135.0	2,080	4,790	3,440	2.28	1.56	1.92	2,130	38.6	32	16	9	243
210	337	80	41.0	.0038	17.7	4.7	.43	75.5	3,180	5,920	4,550	2.12	1.46	1.79	2,580	14.0	72	62	54	112
211	305	100	52.0	.0050	26.6	5.4	.51	159.0	3,190	5,700	4,440	3.04	1.50	2.27	2,690	54.5	60	42	31	167
212	306	100	50.0	.0045	24.6	5.5	.50	165.0	3,020	6,070	4,540	2.28	1.42	1.85	2,750	55.0	63	47	36	154
213	332	79	30.0	.0034	13.6	4.0	.45	192.0	3,300	5,690	4,490	2.20	1.38	1.79	2,200	52.0	71	58	48	123
214	333	80	33.0	.0036	18.4	5.1	.56	145.0	3,330	6,170	4,750	2.98	1.64	2.31	2,360	58.3	75	62	52	111
215	334	80	31.0	.0034	12.9	3.8	.42	210.0	2,890	5,020	3,960	2.10	1.38	1.74	1,850	45.0	74	63	54	109
216	335	80	38.0	.0041	16.6	4.1	.44	190.0	3,040	5,410	4,230	2.18	1.56	1.87	2,110	50.7	77	67	59	97
217	377	100	42.0	.0034	22.8	6.7	.54	180.0	3,240	5,480	4,860	2.90	1.54	2.22	2,960	50.1	29	15	10	246
218	310	100	49.0	.0040	26.2	6.6	.53	189.0	2,720	5,920	4,320	2.96	1.72	2.34	2,950	43.1	30	15	9	246
219	297	100	38.0	.0032	20.0	6.3	.53	236.0	2,870	5,710	4,290	2.08	1.46	1.77	2,910	34.3	37	22	15	226
220	294	100	39.0	.0036	23.1	6.4	.39	278.0	2,300	5,560	3,930	2.92	1.40	2.16	2,660	36.2	54	37	29	180
221	299	100	41.0	.0037	23.8	6.4	.58	202.0	3,400	6,060	4,730	2.06	1.34	1.70	2,950	40.4	56	40	31	173
222	[1]1	75	32.0	.0029	8.8	3.0	.28	256.0	1,880	3,740	2,810	1.26	.82	1.04	1,760	39.2	65	59	58	118
222	444	80	32.0	.0040	11.9	3.0	.37	194.0	2,730	4,700	3,720	1.68	.88	1.28	1,610	51.9	72	60	52	116
223	475	100	29.0	.0025	13.4	5.4	.46	192.0	2,210	5,130	3,670	2.54	1.18	1.86	2,540	41.5	44	31	25	200
224	476	100	35.0	.0031	20.6	6.6	.59	151.0	2,620	5,880	4,250	3.28	1.30	2.29	2,810	47.6	50	36	29	185
225	477	100	32.0	.0026	20.2	7.7	.63	137.0	3,120	6,270	4,700	3.16	1.48	2.32	3,200	54.3	54	41	34	171
226	478	100	32.0	.0033	14.0	4.2	.44	164.0	2,730	4,600	3,660	2.56	1.24	1.90	2,210	50.8	66	56	47	131
227	473	100	33.0	.0038	10.6	2.8	.32	225.0	2,440	3,610	3,020	2.24	1.12	1.68	1,520	42.0	78	68	63	91
228	479	100	35.0	.0028	21.4	7.6	.61	149.0	3,050	6,790	4,920	3.94	1.44	2.69	3,540	54.2	50	38	31	181
229	480	100	34.0	.0031	21.6	6.9	.63	138.0	3,120	6,180	4,650	3.58	1.42	2.50	2,960	53.6	62	48	39	151
230	482	100	37.0	.0033	21.0	6.4	.57	145.0	3,330	5,800	4,560	2.42	1.10	1.76	2,960	55.1	65	52	46	137
231	483	100	36.0	.0040	12.8	3.2	.36	221.0	2,600	4,200	3,400	2.06	1.52	1.59	1,830	42.7	71	60	64	105
232	474	100	35.0	.0043	10.8	2.5	.31	225.0	2,300	3,850	3,080	2.00	1.14	1.57	1,520	44.1	76	67	60	97
233	542	100	46.0	.0036	28.6	8.0	.62	150.0	2,770	6,420	4,600	2.74	1.28	2.01	3,350	49.5	46	32	28	194
234	543	100	37.0	.0030	21.6	7.3	.58	170.0	3,100	6,080	4,590	2.26	.92	1.59	3,230	46.6	49	36	30	185
235	544	100	34.0	.0030	20.6	6.9	.60	163.0	3,090	3,120	3,100	1.92	2.02	1.97	2,060	31.6	57	44	36	163
236	545	100	46.0	.0042	27.2	6.5	.59	140.0	3,020	6,280	4,650	2.62	1.16	1.89	2,960	56.2	69	57	49	125
237	521	100	60.0	.0061	25.8	4.2	.43	193.0	2,740	4,810	3,780	3.04	1.44	2.24	2,200	45.5	76	68	61	95
239	546	100	38.0	.0034	23.9	7.1	.63	135.0	3,080	6,360	4,720	2.16	1.00	1.58	3,220	55.5	58	47	38	157
240	547	100	42.0	.0035	25.4	7.3	.60	137.0	2,890	6,940	4,920	2.74	1.20	1.97	3,290	59.6	59	47	39	155
241	548	100	39.0	.0039	15.0	3.8	.38	212.0	2,630	3,720	3,180	1.84	.92	1.38	1,860	30.4	70	61	54	115

[1] Commercial.

TABLE 7.—*Quality tests—white spruce*—Continued.

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test. Total.	Mullen test. Per 0.001 inch of thickness.	Mullen test. Per pound.	Mullen test. Horsepower per ton divided by strength factor.	Schopper tests. Breaking length. Crosswise.	Schopper tests. Breaking length. Lengthwise.	Schopper tests. Breaking length. Average.	Schopper tests. Stretch. Crosswise.	Schopper tests. Stretch. Lengthwise.	Schopper tests. Stretch. Average.	Schopper tests. Breaking weight per square millimeter, sectional area.	Schopper tests. Breaking length per horsepower per ton.	Tintometer indications. Red.	Tintometer indications. Green.	Tintometer indications. Blue.	Tintometer indications. Black.
		Per ct.	*Lbs.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
242	522	100	44.0	0.0046	17.6	3.8	0.40	203.0	2,550	4,230	3,390	2.22	1.04	1.63	1,920	41.7	77	69	61	93
243	623	80	34.0	.0036	15.5	4.3	.46	272.0	3,110	5,640	4,380	3.10	1.38	2.24	2,370	35.0	80	72	65	83
244	622	80	38.0	.0040	16.4	4.0	.43	226.0	2,530	4,950	3,740	2.68	1.36	2.02	2,040	38.4	80	71	65	84
245	672	80	36.0	.0037	16.1	4.4	.45	188.0	3,140	6,140	4,640	1.96	1.16	1.56	2,340	55.0	78	68	64	90
246	652	80	37.0	.0040	16.4	4.0	.44	221.0	3,060	5,390	4,220	2.86	1.06	1.96	2,180	43.3	74	67	62	97
247	624	80	36.0	.0040	14.8	3.7	.41	259.0	2,610	4,960	2,780	2.96	1.40	2.18	1,930	26.2	78	71	63	88
248	625	80	41.0	.0045	13.4	3.0	.33	202.0	2,350	4,250	3,300	2.22	1.22	1.72	1,760	49.6	76	70	64	90
249	666	80	44.0	.0040	21.0	5.3	.48	394.0	3,280	5,580	4,430	2.28	1.14	1.71	2,700	23.4	71	63	56	110
250	662	80	34.0	.0031	16.8	5.5	.53	290.0	3,380	6,660	5,020	2.58	1.44	2.01	2,880	32.7	76	67	61	96
251	627	80	33.0	.0034	17.2	5.1	.52	281.0	2,870	6,110	4,490	2.58	1.24	1.91	2,640	30.7	70	61	57	112
252	660	80	37.0	.0036	19.4	5.4	.52	414.0	3,370	6,730	5,050	1.86	1.30	1.58	2,840	23.5	73	64	58	105
253	661	80	37.0	.0035	20.0	5.7	.54	330.0	3,580	6,660	5,120	2.30	1.30	1.80	3,000	28.7	76	68	60	96
254	626	80	40.0	.0036	20.6	5.7	.52	394.0	3,180	6,270	4,720	2.72	1.30	2.01	2,960	23.0	77	66	62	95
255	657	84	35.0	.0038	10.3	2.7	.29	312.0	2,650	4,690	3,670	1.54	1.02	1.28	1,780	40.5	59	49	43	149
256	633	80	40.0	.0042	18.7	4.4	.47	274.0	3,030	5,140	4,080	1.98	.84	1.41	2,140	31.6	77	68	60	95
257[1]	648	80	36.0	.0040	15.8	4.0	.44	336.0	3,230	6,380	4,800	2.22	1.10	1.66	2,270	32.4	75	70	63	92
258	644	80	36.0	.0041	13.6	3.4	.38	253.0	3,000	5,270	4,140	2.16	.98	1.57	1,970	43.1	76	70	63	91
259	671	80	37.0	.0044	10.5	2.4	.28	246.0	2,460	4,500	3,480	1.38	.88	1.13	1,450	50.6	81	71	63	85
260	659	80	35.0	.0039	13.9	3.5	.40	244.0	2,870	5,800	4,340	1.84	1.04	1.44	2,070	44.5	77	69	62	92
261	679	80	33.0	.0038	13.0	3.5	.39	214.0	2,980	5,800	4,390	1.84	.94	1.39	2,020	52.5	79	69	63	89
262	668	80	40.0	.0046	14.8	3.2	.37	239.0	2,810	5,210	4,010	1.82	.92	1.37	1,840	45.4	73	65	60	102
263	680	80	39.0	.0045	14.6	3.2	.37	207.0	3,060	5,350	4,200	1.76	.82	1.29	1,960	54.7	80	70	64	86
265	705	100	40.0	.0036	18.0	5.0	.45	130.0	2,420	5,680	4,050	1.48	1.06	1.27	2,560	69.5	47	32	27	194
266	704	100	38.0	.0035	18.4	5.3	.48	119.0	2,160	5,710	3,940	1.10	1.04	1.07	2,470	68.8	50	35	30	185
267	703	100	38.0	.0034	19.8	5.9	.52	111.0	2,350	6,180	4,260	1.28	1.14	1.21	2,650	74.0	55	39	32	174
268	697	100	45.0	.0049	17.4	3.6	.39	127.0	2,280	4,910	3,600	1.28	1.00	1.14	1,880	72.6	65	52	45	138
269	733	80	33.0	.0046	8.6	1.9	.26	188.0	2,050	4,180	3,120	1.42	1.00	1.21	1,130	63.7	77	69	61	93
270	707	100	39.0	.0033	24.0	7.3	.62	104.0	3,620	7,540	5,580	2.54	1.06	1.80	3,680	86.5	52	37	30	181
271	698	100	34.0	.0031	18.6	6.0	.55	103.0	2,630	6,580	4,600	1.42	1.10	1.26	2,910	81.0	52	37	30	181
272	696	100	43.0	.0041	22.5	5.5	.52	112.0	2,890	5,800	4,340	1.88	1.00	1.44	2,700	74.4	50	37	31	182
273	702	100	46.0	.0041	27.0	6.6	.58	99.0	3,190	6,170	4,680	3.22	1.38	2.30	3,000	81.5	59	42	36	163

274.......	699	100	41.0	.0044	17.8	4.1	.43	128.0	2,850	5,250	4,040	1.42	.88	1.15	2,140	73.3	64	53	46	137
275.......	664	100	46.0	.0057	9.2	1.6	.20	265.0	2,320	3,090	2,700	1.20	.82	1.01	1,220	51.0	76	68	61	95
276.......	710	80	33.0	.0042	9.6	2.3	.29	296.0	2,340	4,860	3,600	1.52	.94	1.23	1,540	41.9	84	74	67	75
277.......	665	80	37.0	.0048	9.3	2.0	.30	241.0	2,320	3,930	3,120	1.52	1.02	1.27	1,320	43.2	73	70	62	95
278.......	678	80	44.0	.0054	12.2	2.2	.28	186.0	2,460	4,680	3,570	1.38	.82	1.10	1,510	68.7	81	70	64	85
279.......	676	80	37.0	.0051	7.2	1.4	.19	242.0	1.820	3,360	2,590	1.20	.70	.95	950	56.3	81	71	64	84
280.......	714	80	38.0	.0046	12.7	2.7	.33	251.0	2,260	4,860	3,560	1.96	1.00	1.48	1,640	43.0	81	72	66	81
281.......	635	80	38.0	.0045	13.8	3.1	.36	236.0	2,960	4,950	3,960	2.36	.98	1.67	1,800	46.6	78	72	67	83
282.......	670	80	38.0	.0044	12.7	2.9	.33	312.0	2,810	5,410	4,110	2.00	1.02	1.51	1,900	39.9	75	66	62	97

[1] Pulps for runs 257 to 282, inclusive, were made on a coarse-grit stone.

TABLE 8.—*Grinder runs on balsam fir.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	No. of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Feet per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Ins.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as No. 7 tamarack.	3	20	8.2	175	2,428	189.0	228	1.345	140.5	157.0	23.80	6	27.83	1,710	71.9	9.35	162.1	0.00949
2	....	.....do............	Same surface......	3	40	16.4	175	2,428	323.0	372	3.225	100.2	360.0	23.80	5⅞	27.83	1,792	75.4	19.88	155.0	.00811
3	....	.....do............	.....do............	3	60	24.65	175	2,428	470.0	541	5.695	82.6	661.0	23.80	5	27.83	1,720	72.3	41.25	150.0	.00785
4	....	Diamond point, cut 10 to inch.	Stone dressed.....	3	20	8.2	175	2,428	161.6	178	......	......	......	23.08	5	34.76	......	76.6	.....	137.8	....
5	....	.....do............	Same surface......	3	40	16.4	175	2,428	311.0	344	1.749	178.0	......	......	5	34.76	1,770		8.65	175.3	.00781
6	....	.....do............	.....do............	3	60	24.65	175	2,428	424.0	495	3.485	121.3	371.5	23.08	5⅜	34.76	1,877	81.3	13.50	157.5	.00708
7	Steamed..	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as poplar No. 1.	3	40	16.4	200	2,762	336.0	399	2.710	123.9	354.5	21.07	6⅞	59.45	1,530	72.5	23.20	146.7	.00741
8	....	.....do............	Same as for No. 925 spruce.	3	20	8.2	175	2,417	187.0	210	.835	224.0	86.8	21.44	4¾	58.45	1,923	89.6	10.79	178.8	.00945
9	....	.....do............	Same surface......	3	40	16.4	175	2,417	336.0	378	2.525	133.0	260.0	21.44	4¾	58.45	1,943	90.6	11.24	158.1	.00849
10	....	.....do............	.....do............	3	60	24.65	175	2,417	446.0	517	4.130	108.0	422.5	21.44	4½	58.45	1,956	91.1	19.12	146.9	.00750
11	....	.....do............	.....do............	3	20	8.2	225	3,107	230.0	278	.946	243.5	96.2	21.44	5	58.45	1,968	91.6	10.73	182.8	.00904
12	....	.....do............	.....do............	3	40	16.4	225	3,107	396.9	451	2.390	165.7	240.4	21.44	5⅛	58.45	1,988	92.6	9.65	171.8	.00777
13	....	.....do............	.....do............	3	60	24.65	225	3,107	595.0	660	5.400	110.1	540.0	21.44	4⅞	58.45	2,000	93.2	18.17	145.8	.00776
14	....	.....do............	Same as for poplar No. 2.	3	30	12.3	225	3,085	322.0	358	2.080	154.8	216.0	22.01	4⅝	49.88	1,922	87.4	6.88	178.5	.00848
15	Boiled....	Straight, cut 8 to inch.	Same as No. 15 Montana lodgepole.	2	40	16.4	225	3,080	240.0	292	1.155	208.0	140.9	21.66	5¼	51.23	1,640	75.6	21.45	143.9	.00475
16	...do.....	.....do............	Same surface......	2	60	24.65	225	3,080	317.0	383	1.830	173.2	212.0	21.66	5⅜	51.23	1,728	79.6	25.40	138.0	.00417
17	...do.....	.....do............	.....do............	2	80	32.8	225	3,080	374.0	440	2.227	167.8	264.0	21.66	5⅜	51.23	1,690	78.0	22.70	129.6	.00370
18	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for No. 15 western yellow pine.	3	60	24.65	100	1,366	275.0	306	2.242	122.8	264.0	21.20	5⅞	48.75	1,698	80.0	15.43	97.0	.00816
19	....	.....do............	Same surface......	3	60	24.65	150	2,049	400.0	449	3.320	120.4	354.0	21.20	4¾	48.75	1,876	88.5	19.06	129.5	.00790
20	....	.....do............	.....do............	3	60	24.65	200	2,732	496.0	553	3.880	128.0	428.0	21.20	5⅛	48.75	1,814	85.5	15.80	139.6	.00736

21	....	Straight, cut 2 to inch; spiral, cut 12 to inch.	Same surface......	3	60	24.65	250	3,415	551.0	630	4.325	127.6	463.0	21.20	$5\frac{1}{4}$	48.75	1,870	88.1	19.20	147.6	.00654
22	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as for No. 27 western yellow pine.	3	40	16.4	225	3,069	481.0	543	5.330	90.4	546.0	20.75	$4\frac{7}{8}$	60.40	1,950	94.1	8.45	150.4	.00955
[2] 23	....	....	....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 4 Engelmann spruce.	2	60	16.4	175	2,387	333.0	372	3.225	103.1	338.0	20.20	$5\frac{1}{2}$	61.66	1,910	94.5	18.60	148.0	.00850
25	Steamed..	.....do...........	Same as No. 232 spruce.	2	20	8.2	225	3,048	137.0	171	.953	144.0	113.0	19.92	$5\frac{3}{8}$	61.08	1,680	84.4	13.40	150.0	.00548
26	...do......	.....do...........	Same surface......	2	40	16.4	225	3,048	246.0	286	2.302	106.8	270.0	19.92	$5\frac{1}{4}$	61.08	1,710	85.9	17.30	133.0	.00491
27	...do......	.....do...........	.....do...........	2	60	24.65	225	3,048	311.0	355	3.105	100.0	374.0	19.92	$5\frac{1}{8}$	61.08	1,660	83.3	20.30	136.0	.00414
28	...do......	.....do...........	.....do...........	2	80	32.8	225	3,048	371.0	414	3.755	98.9	441.0	19.92	$5\frac{3}{4}$	61.08	1,700	85.3	30.60	134.0	.00371
29	...do......	.....do...........	.....do...........	2	100	41.0	225	3,048	413.0	491	4.050	102.0	479.0	19.92	$5\frac{1}{2}$	61.08	1,695	85.0	27.50	136.0	.00330

[1] For conditions of cooking see Table 32.

[2] See Runs on mixed woods (commercial).

TABLE 9.—*Grinder runs on red fir.* [1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for spruce No. 41.	3	50	20.5	200	2,775	420.0	489	6.450	65.2	672.0	21.93	[2]	16.98	1,920	87.6	10.94	133.0	0.00739
2	Steamed..	.....do.............	Same as spruce No. 72.	3	40	16.4	200	2,762	288.5	370	2.299	125.7	297.0	23.76	[2]	15.63	1,547	65.1	17.76	166.3	.00636
3	....	.....do.............	Same as California lodgepole No. 2.	3	30	12.3	225	3,085	325.0	374	Qualitative run.				[2]	......	......	......	......	165.1	.00856
4	....	.....do.............	Same as balsam No. 14.	3	30	12.3	225	3,085	304.0	370	1.680	181.0	169.0	24.35	[2]	11.17	1,988	81.6	12.31	178.0	.00800
5	....	.....do.............	Same as California lodgepole No. 3.	3	60	24.65	225	3,085	521.0	574	2.565	203.5	302.0	24.47	[2]	22.40	1,700	69.5	9.83	176.2	.00685
6	....	.....do.............	Same as for No. 8 western hemlock.	3	60	24.65	100	1,366	244.0	282	1.161	210.0	128.0	21.85	[2]	20.13	1,815	83.0	19.10	157.2	.00725
7	....	.....do.............	Same surface....	3	60	24.65	150	2,049	366.0	434	1.088	337.0	136.6	21.85	[2]	20.13	1,590	72.7	12.38	175.3	.00724
8	....	.....do.............	.....do..........	3	60	24.65	200	2,732	425.0	485	1.379	308.0	162.0	21.85	[2]	20.13	1,698	77.6	11.10	178.2	.00630
9	....	.....do.............	.....do..........	3	60	24.65	250	3,415	566.0	647	2.188	258.5	312.0	21.85	[2]	20.13	1,400	64.0	9.60	181.0	.00673
10	....	.....do.............	Same as larch No. 4.	2	20	8.2	225	3,073	153.4	177	.492	312.0	52.5	21.02	[2]	22.72	1,872	89.0	6.40	154.1	.00609
11	....	.....do.............	Same surface....	2	40	16.4	225	3,073	246.0	303	1.165	211.0	130.0	21.02	[2]	22.72	1,790	85.1	7.98	166.3	.00489
12	....	.....do.............	.....do..........	2	60	24.65	225	3,073	376.0	450	1.737	216.5	212.0	21.02	[2]	22.72	1,638	77.8	9.90	166.2	.00496
13	....	.....do.............	.....do..........	2	80	32.8	225	3,073	459.0	543	2.500	183.4	265.0	21.02	[2]	22.72	1,890	89.9	8.51	156.5	.00455
14	....	.....do.............	.....do..........	2	100	41.0	225	3,073	475.0	576	3.275	145.0	362.0	21.02	[2]	22.72	1,810	86.0	16.72	155.7	.00377
15	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 52 tamarack.	2	40	16.4	225	3,069	238.0	286	1.627	146.3	165.0	21.60	[2]	28.87	1,970	91.2	7.76	158.0	.00472

16	....	.....do.............	Same surface....	2	60	24.65	225	3,069	352.0	428	2.806	125.2	282.0	21.60	[2]	28.87	1,998	92.4	9.70	157.7	.00465
17	....	.....do.............	.....do..........	2	80	32.8	225	3,069	462.0	527	4.570	101.1	446.0	21.60	[2]	28.87	2,043	94.6	11.26	149.0	.00459
18	....	.....do.............	.....do..........	2	100	41.0	225	3,069	560.0	632	5.540	101.0	540.0	21.60	[2]	28.87	2,050	94.9	10.37	151.7	.00445
19	....	.....do.............	Same as for No. 26 California lodgepole.	2	80	32.8	225	3,069	483.0	580	5.710	84.6	571.0	21.59	[2]	26.50	2,000	92.7	12.60	158.0	.00479

1 For conditions of cooking see Table 32.

2 Split wood.

TABLE 10.—*Grinder runs on white fir.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 3, Engelmann spruce, Colo.	2	40	16.4	225	3,069	306	342	2.319	132.0	245	19.47	(2)	64.80	1,892	97.2	17.3	155	0.00607
2	....	.....do.............	Same surface....	2	60	24.65	225	3,069	385	442	3.575	107.7	370	19.47	(2)	64.80	1,930	99.1	21.3	150	.00509
3	....	.....do.............	.....do..........	2	80	32.8	225	3,069	469	559	5.295	88.5	529	19.47	(2)	64.80	2,000	102.8	22.6	142	.00465
4	....	.....do.............	Same as for No. 8 Engelmann spruce.	3	60	24.65	100	1,355	276	318	3.180	86.8	296	22.17	(2)	48.76	2,150	97.0	10.7	146	.00825
5	....	.....do.............	Same surface....	3	60	24.65	150	2,033	362	427	3.990	90.7	394	22.17	(2)	48.76	2,025	91.5	12.6	150	.00722
6	....	.....do.............	.....do..........	3	60	24.65	200	2,710	503	609	5.885	85.5	662	22.17	(2)	48.76	1,775	80.1	9.4	135	.00752
7	....	.....do.............	.....do..........	3	60	24.65	250	3,388	556	661	6.650	83.7	582	22.17	(2)	48.76	2,280	102.9	11.5	136	.00665
8	....	.....do.............	Same as No. 18, Engelmann spruce, Colo.	2	40	16.4	175	2,372	223	268	1.921	115.9	189	21.42	(2)	45.50	2,030	94.7	13.6	151	.00574
9	....	.....do.............	Same surface....	2	60	24.65	175	2,372	291	345	2.880	101.0	302	21.42	(2)	45.50	1,910	89.1	15.2	155	.00497
10	....	.....do.............	.....do..........	2	80	32.8	175	2,372	374	440	4.020	93.1	383	21.42	(2)	45.50	2,100	98.0	17.2	148	.00480
11	....	.....do.............	.....do..........	2	100	41.0	175	2,372	407	492	4.775	85.2	477	21.42	(2)	45.50	2,000	93.2	20.2	143	.00419
12	....	.....do.............	.....do..........	2	40	16.4	175	2,372	244	260	2.055	109.0	194	22.76	(2)	50.88	2,120	93.2	8.5	150	.00627
13	....	.....do.............	.....do..........	2	60	24.65	175	2,372	313	350	2.897	108.0	274	22.76	(2)	50.88	2,110	92.9	16.2	154	.00535
14	....	.....do.............	.....do..........	2	80	32.8	175	2,372	390	449	4.470	87.2	438	22.76	(2)	50.88	2,040	89.7	9.6	145	.00501
15	....	.....do.............	.....do..........	2	100	41.0	175	2,372	443	516	5.250	84.4	500	22.76	(2)	50.88	2,100	92.4	14.6	142	.00455
16	....	Spiral, cut 8 to inch	Stone dressed....	3	40	16.4	175	2,372	218	274	(3)	(3)	(3)	20.82	(2)	49.97	(3)	(3)	(3)	133	.00560
17	....	Diamond point, 6 to inch.	.....do..........	2	40	16.4	175	2,372	232	280	2.160	107.2	229	20.82	(2)	49.97	1,888	90.5	5.3	147	.00596
18	....	.....do.............	Same surface....	2	60	24.65	175	2,372	325	365	3.255	100.0	364	20.82	(2)	49.97	1,790	85.9	12.6	151	.00555
19	....	.....do.............	.....do..........	2	80	32.8	175	2,372	395	465	4.630	85.4	476	20.82	(2)	49.97	1,945	93.4	14.6	151	.00508
20	....	.....do.............	.....do..........	2	100	41.0	175	2,372	467	558	6.210	75.2	681	20.82	(2)	49.97	1,825	87.5	15.5	141	.00480
21	Steamed..	.....do.............	.....do..........	2	40	16.4	200	2,710	231	271	1.925	120.0	238	20.82	(2)	49.97	1,620	77.7	30.0	143	.00520
22	...do......	.....do.............	.....do..........	2	60	24.65	206	2,794	320	364	2.800	114.0	375	20.82	(2)	49.97	1,490	71.5	21.5	144	.00465
23	...do......	.....do.............	.....do..........	2	80	32.8	209	2,835	395	449	4.005	98.6	488	20.82	(2)	49.97	1,645	79.1	27.6	139	.00425
24	...do......	.....do.............	.....do..........	2	100	41.0	210	2,845	468	555	4.815	97.1	617	20.82	(2)	49.97	1,560	74.9	28.8	134	.00401
25	...do......	.....do.............	.....do..........	3	60	24.65	198	2,682	322	371	3.370	95.5	388	20.82	(2)	49.97	1,740	83.5	25.0	134	.00486
26	...do......	.....do.............	.....do..........	3	60	24.65	189	2,561	320	372	3.585	89.2	395	20.82	(2)	49.97	1,813	87.0	27.2	137	.00506

27	...do......	.....do............	Stone dressed....	2	60	24.65	100	1,355	195	226	1.725	113.0	179	21.85	(2)	38.90	1,930	88.3	10.0	149	.00584
28	....	.....do............	Same surface....	2	60	24.65	150	2,033	280	326	2.605	107.3	249	21.85	(2)	38.90	2,093	95.6	13.3	158	.00559
29	....	.....do............	.....do..........	2	60	24.65	200	2,710	381	425	3.930	97.0	387	21.85	(2)	38.90	2,030	92.8	13.4	158	.00570
30	....	.....do............	.....do..........	2	60	24.65	250	3,388	449	500	4.755	94.5	445	21.85	(2)	38.90	2,140	97.9	6.5	144	.00536
31	....	.....do............	.....do..........	2	60	24.65	100	1,355	196	231	1.750	112.0	171	22.18	(2)	34.15	2,040	92.0	15.7	150	.00586
32	....	.....do............	.....do..........	2	60	24.65	150	2,033	280	329	2.298	122.0	225	22.18	(2)	34.15	2,040	92.0	14.0	160	.00559
33	....	.....do............	.....do..........	2	60	24.65	200	2,710	400	459	3.500	114.2	338	22.18	(2)	34.15	2,075	93.5	27.0	164	.00599
34	....	.....do............	.....do..........	2	60	24.65	250	3,388	455	509	3.945	115.0	393	22.18	(2)	34.15	2,005	90.5	12.9	158	.00544
35	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Stone dressed...	3	45	18.5	225	3,020	384	477	4.775	80.4	498	20.80	(2)	20.58	1,920	92.2	16.4	162	.00687

[1] For conditions of cooking see Table 32.

Split wood.

[3] No production data.

TABLE 11.—*Grinder runs on Alpine fir.*[1]

Run No.	Preliminary treatment of wood.	Stone.		Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
		Kind of burr.	Surface.																		
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	....	Diamond point, 6 to inch; spiral, cut 12 to inch.	Same as No. 14 amabilis fir.	2	40	16.40	225	3,049	312	371	2.647	117.7	252	22.30	$6\frac{7}{8}$	47.25	2,095	93.9	6.35	148	0.00624
2	....	.....do.............	Same surface....	2	60	24.65	225	3,049	412	469	4.430	93.0	429	22.30	$7\frac{1}{8}$	47.25	2,065	92.6	14.10	137	.00548
3	....	.....do.............	.....do...........	2	80	32.80	225	3,049	513	591	6.510	78.7	627	22.30	$7\frac{1}{8}$	47.25	2,078	93.0	27.80	131	.00513
4	....	.....do.............	.....do...........	2	100	41.00	225	3,049	611	660	8.050	75.9	795	22.30	7	47.25	2,022	90.7	21.80	127	.00490
5	....	Spiral, cut 12 to inch; straight, cut 3 to inch.	Stone dressed...	2	60	24.65	100	1,355	204	253	2.045	99.7	207	22.30	$6\frac{1}{2}$	47.25	1,977	88.6	16.90	140	.00611
6	....	.....do.............	Same surface....	2	60	24.65	150	2,033	320	361	3.280	97.5	319	22.30	$6\frac{3}{4}$	47.25	2,056	92.1	16.10	147	.00638
7	....	.....do.............	.....do...........	2	60	24.65	200	2,710	365	420	3.940	92.6	369	22.30	$6\frac{5}{8}$	47.25	2,135	95.6	14.30	139	.00546
8	....	.....do.............	.....do...........	2	60	24.65	250	3,388	465	509	5.435	85.6	533	22.30	7	47.25	2,038	91.4	14.30	133	.00556
9	Steamed..	.....do.............	.....do...........	2	40	16.40	225	3,049	264	317	2.125	124.0	242	22.30	$7\frac{1}{8}$	47.25	1,757	78.8	34.40	134	.00528
10	...do......	.....do.............	.....do...........	2	60	24.65	225	3,049	357	410	3.775	94.7	413	22.30	7	47.25	1,830	82.1	70.50	120	.00475
11	...do......	.....do.............	.....do...........	2	80	32.80	225	3,049	420	497	4.715	89.0	526	22.30	7	47.25	1,788	80.1	91.90	120	.00420
12	...do......	.....do.............	.....do...........	2	100	41.00	225	3,049	475	537	5.375	88.4	629	22.30	$6\frac{1}{4}$	47.25	1,710	76.7	101.00	117	.00380
13	....	.....do.............	Stone dressed...	3	50	20.50	225	3,020	430	579	5.110	84.0	479	21.60	$7\frac{3}{8}$	43.00	2,135	98.9	16.2	156	.00695

[1] For conditions of cooking see Table 32.

TABLE 12.—*Grinder runs on amabilis fir.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	....	Diamond point, 6 to inch; spiral, cut 12 to inch.	Stone dressed...	2	40	16.40	225	3,049	296	349	3.200	92.5	339	20.96	(2)	47.56	1,888	90.1	5.60	145	0.00591
2	....	.....do............	Same surface....	2	60	24.65	225	3,049	398	455	4.930	80.8	518	20.96	(2)	47.56	1,905	91.0	8.43	142	.00529
3	....	.....do............	.....do..........	2	80	32.80	225	3,049	484	569	6.850	70.6	735	20.96	(2)	47.56	1,863	89.0	10.20	132	.00484
4	....	.....do............	.....do..........	2	100	41.00	225	3,049	581	670	8.760	66.3	975	20.96	(2)	47.56	1,800	86.0	12.40	138	.00465
5	....	.....do............	.....do..........	2	60	24.65	100	1,355	195	228	2.170	90.0	233	20.96	(2)	47.56	1,862	89.0	10.50	140	.00584
6	....	.....do............	.....do..........	2	60	24.65	150	2,033	275	330	2.945	93.5	332	20.96	(2)	47.56	1,773	84.7	8.05	142	.00549
7	....	.....do............	.....do..........	2	60	24.65	200	2,710	376	432	4.125	91.2	461	20.96	(2)	47.56	1,790	85.5	9.00	147	.00563
8	....	.....do............	.....do..........	2	60	24.65	250	3,388	454	509	5.800	78.2	596	20.96	(2)	47.56	1,948	93.0	13.60	137	.00543
9	Steamed..	.....do............	.....do..........	2	40	16.40	225	3,049	223	282	1.728	129.0	226	20.96	(2)	47.56	1,530	73.0	20.60	131	.00445
10	...do......	.....do............	.....do..........	2	60	24.65	225	3,049	320	381	3.225	99.2	421	20.96	(2)	47.56	1,532	73.1	34.60	124	.00425
11	...do......	.....do............	.....do..........	2	80	32.80	225	3,049	368	447	3.530	104.0	468	20.96	(2)	47.56	1,510	72.1	40.90	123	.00368
12	...do......	.....do............	.....do..........	2	100	41.00	225	3,049	434	514	4.430	98.0	589	20.96	(2)	47.56	1,505	71.9	38.20	120	.00347
13	...do......	.....do............	.....do..........	2	60	24.65	211	2,860	324	394	2.920	111.0	352	20.96	(2)	47.56	1,660	79.2	18.90	138	.00459
14	...do......	.....do............	.....do..........	2	60	24.65	181	2,455	323	390	3.240	99.7	355	20.96	(2)	47.56	1,822	87.0	14.00	138	.00534
15	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Stone dressed...	2	80	32.80	225	3,029	397	502	4.900	81.0	485	21.10	(2)	25.27	2,020	95.7	10.30	159	.00401

[1] For conditions of cooking see Table 32.

[2] Split wood.

TABLE 13.—*Grinder runs on lowland fir (Montana).*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	°*F.*	
1	Steamed..	Spiral, cut 8 to inch; straight, cut 10 to inch.	Stone dressed...	2	40	16.40	175	2,348	157	195	1.855	84.6	224	21.40	8¼	48.00	1,660	77.5	21.6	122	0.00407
2	...do......	.....do............	Same surface....	2	60	24.65	175	2,348	221	273	2.765	80.0	344	21.40	8⅞	48.00	1,610	75.2	32.9	119	.00382
3	...do......	.....do............	.....do..........	2	80	32.80	175	2,348	283	342	3.445	82.1	409	21.40	8	48.00	1,683	78.7	25.7	119	.00367
4	....	.....do............	.....do..........	2	40	16.40	175	2,348	207	260	2.980	69.5	320	21.40	9	48.00	1,862	87.0	7.6	136	.00538
5	....	.....do............	.....do..........	2	60	24.65	175	2,348	280	322	4.465	62.6	475	21.40	8⅜	48.00	1,880	87.9	8.4	136	.00483
6	....	.....do............	.....do..........	2	80	32.80	175	2,348	347	387	5.650	61.4	605	21.40	8½	48.00	1,870	87.4	8.7	127	.00450
7	....	.....do............	.....do..........	2	40	16.40	100	1,342	141	176	1.730	81.5	192	21.40	8⅝	48.00	1,805	84.3	5.7	139	.00640
8	....	.....do............	.....do..........	2	40	16.40	150	2,013	185	218	2.290	80.7	240	21.40	8	48.00	1,910	89.2	8.2	143	.00561
9	....	.....do............	.....do..........	2	40	16.40	200	2,684	226	276	2.735	82.8	290	21.40	8¼	48.00	1,888	88.1	5.5	139	.00513
10	....	.....do............	.....do..........	2	40	16.40	250	3,355	255	317	3.405	74.9	370	21.40	8⅞	48.00	1,837	85.8	5.5	136	.00464
11	....	.....do............	Same as No. 19 Engelmann spruce (Mont.).	2	40	16.40	175	2,348	213	258	2.345	90.3	234	21.65	6¼	46.40	2,000	92.4	4.9	142	.00553
12	....	.....do............	Same surface....	2	60	24.65	175	2,348	294	339	3.750	78.4	366	21.65	6¾	46.40	2,045	94.5	6.3	138	.00507
13	....	.....do............	.....do..........	2	80	32.80	175	2,348	358	413	5.100	70.3	488	21.65	7	46.40	2,090	96.5	6.9	139	.00465
14	....	.....do............	.....do..........	2	60	24.65	100	1,342	192	226	2.315	83.0	224	21.65	6⅜	46.40	2,060	95.1	4.8	132	.00580
15	....	.....do............	.....do..........	2	60	24.65	150	2,013	273	311	3.245	84.2	329	21.65	7⅛	46.40	1,970	91.0	4.8	140	.00551
16	....	.....do............	.....do..........	2	60	24.65	200	2,684	353	403	4.265	82.6	409	21.65	6⅝	46.40	2,090	96.5	5.2	138	.00533
17	....	.....do............	.....do..........	2	60	24.65	250	3,355	384	436	4.790	80.3	492	21.65	6¾	46.40	1,941	89.7	4.4	142	.00465

[1] For conditions of cooking see Table 32.

TABLE 14.—*Grinder runs on noble fir.*[1]

Run No.	Preliminary treatment of wood.	Stone: Kind of burr.	Stone: Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	Lbs.		Ft. per minute.			Tons.		Cu. ft.	Lbs.	Inches.	P. ct.	Lbs.	P. ct.	Lbs.	°F.	
1	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Stone dressed...	2	40	16.40	225	3,020	222	307	1.980	112.0	216	21.05	....	34.80	1,835	87.1	17.4	143	0.00449
2	....	.....do...........	Same surface....	2	60	24.65	225	3,020	290	413	3.410	85.0	345	21.05	....	34.80	1,980	94.0	20.1	131	.00389
3	....	.....do...........	.....do.........	2	80	32.80	225	3,020	406	487	5.100	79.6	487	21.05	....	34.80	2,090	99.2	18.9	131	.00410
4	....	.....do...........	.....do.........	2	100	41.00	225	3,020	470	581	6.750	69.5	695	21.05	....	34.80	1,950	92.6	22.6	118	.00380
5	....	.....do...........	.....do.........	2	60	24.65	100	1,342	190	218	2.275	83.5	252	21.05	....	34.80	1,805	85.7	22.0	125	.00574
9	....	.....do...........	.....do.........	2	60	24.65	150	2,013	233	284	2.920	79.8	311	21.05	....	34.80	1,875	89.0	16.5	123	.00470
6	....	.....do...........	.....do.........	2	60	24.65	200	2.684	290	370	3.340	86.8	336	21.05	....	34.80	1,990	94.5	15.7	132	.00437
7	....	.....do...........	.....do.........	2	60	24.65	250	3,355	336	392	3.990	84.2	386	21.05	....	34.80	2,060	97.9	11.2	128	.00406
8	Steamed..	.....do...........	.....do.........	2	40	16.40	225	3,020	189	256	1.990	95.5	272	21.05	....	34.80	1,465	69.6	33.6	121	.00382
10	.....do.....	.....do...........	.....do.........	2	60	24.65	225	3,020	271	326	2.965	91.3	441	21.05	....	34.80	1,342	63.8	82.1	116	.00364
11	.....do.....	.....do...........	.....do.........	2	80	32.80	225	3,020	314	407	3.290	95.5	437	21.05	....	34.80	1,502	71.4	89.5	112	.00317
12	.....do.....	.....do...........	.....do.........	2	60	24.65	225	3,020	296	382	2.930	101.0	315	21.05	....	34.80	1,860	88.4	44.4	123	.00398
13	....	.....do...........	.....do.........	2	60	24.65	225	3,020	313	356	4.070	76.9	414	21.05	....	34.80	1,969	93.5	16.4	123	.00421
14	....	.....do...........	Same as No. 256 spruce.	2	80	32.80	225	3,020	438	492	5.390	81.4	564	20.96	....	36.60	1,916	91.5	21.0	130	.00443
15	....	.....do...........	Same surface....	2	80	32.80	225	3,020	415	462	4.450	93.2	456	21.20	....	33.25	1,950	92.0	21.2	132	.00419
16	....	.....do...........	Stone dressed...	3	50	20.50	225	3,020	393	504	4.275	92.0	442	21.05	....	34.80	1,933	91.9	14.8	151	.00636
[2] 17	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as No. 275 spruce.	2	40	16.40	200	2,774	277	319	4.560	60.7	571	21.05	....	34.80	1,595	75.7	332.0	117	.00609
[2] 18	....	.....do...........	Same as No. 17..	2	20	8.20	200	2,774	155	195	2.150	72.0	220	21.05	....	34.80	1,950	92.6	35.9	130	.00682

[1] For conditions of cooking see Table 34.

[2] Nos. 17 and 18 were run on a coarse-grit stone.

TABLE 15.—*Grinder runs on hemlock.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
0		Straight, cut 10 to inch.	Stone dressed	3	50	20.5	170	2,380	288.0											131.0	0.005904
1		do	Same surface	3	30	12.3	100	1,400	154.0											126.0	.008895
2		do	do	3	30	12.3	150	2,100	202.0											143.0	.007785
3		do	do	3	30	12.3	200	2,800	275.0											150.0	.007944
4		do	do	3	30	12.3	225	3,150	301.0											155.0	.007725
5		do	do	3	20	8.2	150	2,100	169.5		1.011	167.7								159.0	.00984
6		do	do	3	20	8.2	175	2,450	210.0		1.380	152.0								170.0	.010446
7		do	do	3	20	8.2	225	3,150	223.0	332.0	1.295	172.0								169.0	.00864
2–1		do	do	3	30	12.3	150	2,100	254.0	328.0	1.965	129.0								167.0	.00983
8		do	do	3	40	16.4	175	2,450	328.0	416.0	3,055	107.3								166.0	.00816
9		do	do	3	60	24.65	175	2,450	430.0	531.0	4.730	91.0								168.0	.00711
10		Spiral, cut 10 to inch.	Stone dressed	3	20	8.2	100	1,393	87.3	106.5										129.0	.00763
11		do	Same surface	3	40	16.4	175	2,440	259.0	363.0	1.430	181.0								170.0	.00647
12		do	do	3	50	20.5	225	3,150	368.0	500.0	2.475	149.0								178.0	.00570
13		do	do	3	60	24.65	225	3,150	475.0	615.0	3.595	132.0								171.0	.006115
14		do	Stone dressed	3	50	20.5	175	2,440	358.0	475.0	3.395	105.6								166.0	.00716
15		do	Same surface	3	60	24.65	175	2,440	397.0	518.0	4.044	98.4								161.5	.00660
16		do	Stone dressed	3	30	12.3	175	2,440	243.0	296.0										148.5	.00806
17		do	do	3	30	12.3	200	2,790	297.0	371.0										146.0	.00861
18		do	Same surface	3	30	12.3	100	1,390	162.8	214.0										158.0	.00951
19		do	do	3	50	20.5	100	1,390	261.0	313.0	2.470	105.7								157.0	.00915
20		do	do	3	40	16.4	200	2,790	377.0	516.0	3.780	99.7								162.0	.00824
21		do	do	3	60	24.65	100	1,400	281.0	412.0	2.810	100.0								160.0	.00813
22		do	do	3	50	20.5	150	2,090	366.0	481.0	3,815	96.0								161.5	.00854
23		Diamond point, cut 10 to inch.	Stone dressed	3	40	16.4	175	2,440	347.0	473.0	3,360	103.2								159.0	.00867
24		do	Same surface	3	50	20.5	175	2,440	394.0	555.0	5.065	77.7								157.0	.00788
25		do	do	3	60	24.65	100	1,390	291.5	348.0	3.312	88.0								156.0	.00850
26		do	do	3	30	12.3	200	2,782	315.0	362.0	2.945	107.0								163.0	.00920
27		do	do	3	50	20.5	200	2,782	432.0	551.0	5.400	80.0								160.5	.00757
28		Natural surface	Stone dressed	3	60	24.65	101	1,408	290.0	324.0										168.0	.00837

29		do	Same surface	3	50	20.5	175	2,435	372.0	417.0										187.0	.00745
30		Straight, cut 10 to inch and 4 to inch.	Stone dressed	3	40	16.4	175	2,435	319.0	389.0	3.900	81.8								145.0	.00799
31		do	do	3	60	24.65	100	1,390	269.0	344.0	3.330	80.9								145.0	.00784
32		do	do	3	60	24.65	100	1,390	298.0	363.0	3.120	95.5								155.0	.00870
33		do	Same surface	3	50	20.5	175	2,435	376.0	500.0	4.000	94.0								163.0	.00753
34		Spiral, cut 4 to inch	Stone dressed	3	60	24.65	100	1,390	297.0	342.0	4.350	68.3								135.0	.00866
35		do	do	3	60	24.65	100	1,390	284.0	342.0	2.915	97.5								147.0	.00828
36		do	Same surface	3	60	24.65	150	2,090	417.0	489.0	5.130	81.4								152.0	.00809
37		do	do	3	60	24.65	200	2,782	520.0	630.0	6.890	75.5								154.0	.00757
38		do	do	3	50	20.5	84	1,173	212.0	241.0	2.660	79.7								154.0	.00880
39		do	do	3	60	24.65	85	1,183	271.0	313.0	2.955	91.8								150.0	.00927
40		do	do	3	50	20.5	100	1,390	285.0	330.0	3.025	94.3								156.0	.01000
41		do	do	3	50	20.5	150	2,090	379.0	440.0	4.450	85.2								155.0	.00885
42		do	do	3	50	20.5	175	2,435	429.0	506.0	5.295	81.1								155.0	.00859
43		do	do	3	50	20.5	200	2,782	439.0	545.0	5.425	80.9								145.0	.00769
44		do	do	3	40	16.4	175	2,435	359.0	411.0	4.225	85.0								158.0	.00900
45		Straight, cut 3 to inch.	Stone dressed	3	40	16.4	200	2,800	340.0	417.0	2.915	116.5								159.0	.00740
47		do	do	3	55	22.6	200	2,800	516.0	594.0	5.370	96.2								161.0	.00815
48		do	Same surface	3	50	20.5	225	3,145	510.0	579.0	6.235	81.8								164.0	.00790
50		Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	3	50	20.5	175	2,445	422.5	488.0	5.300	79.7	512.0	24.84		46.53	2,070	83.5		170.6	.00842
[2] 51																					
[2] 52																					
53	Steamed	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for jack pine No. 25.	3	40	16.4	250	3,460	428.0	504.0	5.655	75.7	536.0	26.34	$5\frac{1}{2}$	39.61	2,110	80.1	27.90	131.5	.00754
54	Boiled	do	Stone dressed	3	40	16.4	200	2,762	307.0	364.0	4.155	73.9	421.0	24.34	$6\frac{1}{8}$	44.11	1,972	81.1	18.86	120.9	.00677
55	Steamed	do	Same as for jack pine No. 26.	3	40	16.4	200	2,762	313.0	367.0	2.525	124.0	290.0	25.10	$6\frac{1}{4}$	45.27	1,741	69.4	24.65	157.8	.00690
56		do	Same as for jack pine No. 27.	3	30	12.3	225	3,085	300.0	342.0	1.430	210.0	142.7	25.68	$6\frac{3}{4}$	41.63	2,005	78.1	6.59	186.2	.00790
57		do	Same as for western hemlock No. 4.	3	20	8.2	250	3,427	222.5	259.0	1.305	170.8	136.7	24.90	$5\frac{7}{8}$	45.36	1,910	76.7	8.59	175.3	.00792
58		do	Same surface	3	40	16.4	250	3,427	390.0	450.0	3.485	112.0	340.0	24.90	6	45.36	2,050	82.4	8.84	162.6	.00694
59		do	do	3	60	24.65	250	3,427	541.0	630.0	5.580	97.0	561.0	24.90	$5\frac{7}{8}$	45.36	1,990	80.0	12.90	158.7	.00640
60	Boiled	Straight, cut 8 to inch.	Same as jack pine No. 20.	2	40	16.4	225	3,080	220.0	275.0	1.118	197.2	143.2	23.75	$5\frac{3}{4}$	45.31	1,560	65.7	12.30	156.3	.00435
61	do	do	Same surface	2	60	24.65	225	3,080	315.0	352.0	2.379	132.5	281.0	23.75	$5\frac{3}{4}$	45.31	1,694	71.4	17.76	143.2	.00415
62	do	do	do	2	80	32.8	225	3,080	358.0	431.0	2.755	130.3	336.0	23.75	$5\frac{5}{8}$	45.31	1,640	69.1	25.90	142.0	.00354
[2] 63																					

[1] For conditions of cooking see Table 32.

[2] See Commercial runs on mixed woods.

NOTE.—For runs 46 (*a*, *b*, and *c*) and 49 (*a* and *b*) see for runs on mixed woods.

TABLE 16.—*Grinder runs on western hemlock.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Feet per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	.....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for Sitka spruce No. 1.	3	30	12.30	225	3,085	305	354	2.270	134.5	218.0	24.40	(2)	27.73	2,080	85.2	10.91	178.9	0.00803
2	.....	do	Same as for Sitka spruce No. 4.	3	20	8.20	250	3,427	218	258	1.715	127.0	144.0	28.35	(2)	24.15	2,380	84.0	8.85	161.1	.00775
3	.....	do	Same surface	3	40	16.40	250	3,427	326	391	3.480	93.7	288.0	28.35	(2)	24.15	2,420	85.4	13.50	154.3	.00580
4	.....	do	do	3	60	24.65	250	3,427	552	625	5.850	94.4	524.0	28.35	(2)	24.15	2,235	78.8	13.46	150.3	.00654
5	.....	do	Same as No. 11 Sitka spruce.	3	60	24.65	100	1,366	252	309	1.935	130.0	189.0	23.42	(2)	25.20	2,042	87.2	14.10	149.9	.00749
6	.....	do	Same surface	3	60	24.65	150	2,049	339	388	2.390	142.0	241.5	23.42	(2)	25.20	1,980	84.5	12.92	157.3	.00670
7	.....	do	do	3	60	24.65	200	2,732	447	512	2.715	165.0	258.0	23.42	(2)	25.20	2,106	89.9	11.90	164.8	.00664
8	.....	do	do	3	60	24.65	250	3,415	539	617	2.800	192.2	270.0	23.42	(2)	25.20	2,072	88.4	12.60	168.4	.00640
9	Steamed	do	Same as No. 6 larch.	3	60	24.65	200	2,732	348	406	1.892	183.7	237.0	23.58	(2)	26.62	1,595	67.6	14.65	123.8	.00516
10	.....	do	Same surface	3	60	24.65	172	2,350	340	415	1.291	263.0	151.0	23.58	(2)	26.62	1,715	72.8	7.78	164.9	.00586
11	.....	do	Same as No. 49 tamarack.	2	40	16.40	225	3,073	267	314	3.130	85.3	277.0	24.77	(2)	24.20	2,260	91.3	8.56	116.0	.00530
12	.....	do	Same surface	2	60	24.65	225	3,073	336	389	4.550	73.9	403.0	24.77	(2)	24.20	2,260	91.3	17.80	103.6	.00444
13	.....	do	do	2	80	32.80	225	3,073	430	490	6.130	70.2	571.0	24.77	(2)	24.20	2,145	86.6	16.30	117.5	.00426
14	.....	do	do	2	100	41.00	225	3,073	480	549	7.690	62.5	675.0	24.77	(2)	24.20	2,278	92.0	19.96	110.7	.00381
[3] 15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
[3] 16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
[3] 17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	.....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	3	50	20.50	225	3,069	479	566	3.800	126.0	338.0	24.77	(2)	24.20	2,250	91.0	10.80	169.0	.00760

[1] For conditions of cooking see Table 32.

[2] Split wood.

[3] For runs 15 to 17, inclusive, see runs on "Mixtures of woods."

TABLE 17.—*Grinder runs on tamarack.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	Lbs.		Ft. per minute.			Tons.		Cu. ft.	Lbs.	Inches.	P. ct.	Lbs.	P. ct.	Lbs.	°F.	
[2]1	......	Straight, cut 3 to inch; spiral, cut 12 to inch.	......	3	40 50	16.4 20.5	175	2,445	368	470	4.380	96.8	......	......	......	......	......	......	......	161.0	......
[2]1	......	...do...	......	3	50	20.5	175	2,445	400	451	4.332	92.3	......	......	......	......	......	......	......	167.4	......
[2]1	......	...do...	......	3	50	20.5	175	2,445	......	......	......	......	......	......	......	......	......	......	......	......	......
[2]1	......	...do...	......	3	50	20.5	175	2,445	403	457	4.563	88.5	......	......	......	......	......	......	......	179.3	......
[2]1	......	...do...	......	3	50	20.5	175	2,445	406	442	4.445	91.4	......	......	......	......	......	......	......	167.0	......
		Weighted averages.	......	3	50	20.5	175	2,445	400	......	4.500	90.0	......	32.38	......	24.41	2,648	81.9	......	174.6	......
2	......	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for No. 7 Montana lodgepole pine.	3	20	8.2	175	2,428	188	219	1.046	179.8	90.6	32.22	$5\frac{3}{4}$	26.22	2,305	71.5	11.65	178.7	0.00944
3	......	...do...	Same surface...	3	40	16.4	175	2,428	332	377	3.725	89.1	286.0	32.22	$5\frac{7}{8}$	26.22	2,606	80.9	11.09	161.2	.00834
4	......	...do...	...do...	3	60	24.65	175	2,428	456	514	5.905	77.3	460.0	32.22	$5\frac{5}{8}$	26.22	2,570	79.7	14.20	161.2	.00761
5	......	...do...	...do...	3	20	8.2	225	3,122	229	261	1.660	138.0	125.9	33.52	$5\frac{3}{4}$	29.18	2,640	78.8	10.94	171.0	.00894
6	......	...do...	...do...	3	40	16.4	225	3,122	410	484	4.930	83.2	355.0	33.52	$5\frac{7}{8}$	29.18	2,780	82.9	10.77	151.7	.00800
7	......	...do...	...do...	3	60	24.65	225	3,122	580	656	8.265	70.1	608.0	33.52	$5\frac{3}{4}$	29.18	2,720	81.1	12.47	147.6	.00753
8	......	Diamond point, 6 to inch.	Stone dressed...	3	20	8.4	175	2,428	145	171	......	......	......	32.25	$5\frac{3}{4}$	27.20	......	......	......	142.7	.00728
9	......	...do...	Same surface...	3	60	24.65	175	2,428	422	485	1.542	273.0	......	32.25	$5\frac{3}{4}$	27.20	......	......	......	174.0	.00705
10	......	...do...	...do...	3	60	24.65	250	3,470	592	621	1.880	315.0	200.0	32.25	$5\frac{3}{4}$	27.20	1,880	58.3	......	151.0	.00691
11	......	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for No. 2 western yellow pine.	3	40	16.4	200	2,762	334	384	6.215	53.7	505.0	32.25	6	27.20	2,460	76.2	12.5	123.4	.00736
12	Steamed..	...do...	Same surface...	3	40	16.4	200	2,762	306	356	4.470	68.5	359.0	32.25	$5\frac{7}{8}$	27.20	2,490	77.1	11.8	133.4	.00675
13	...do...	...do...	...do...	3	40	16.4	200	2,762	340	391	5.000	68.0	348.0	33.37	$5\frac{3}{8}$	29.56	2,873	86.1	15.4	136.1	.00750
14	...do...	...do...	...do...	3	40	16.4	200	2,762	347	387	5.510	63.0	404.0	32.78	$6\frac{1}{4}$	28.88	2,730	83.4	9.51	133.0	.00765
15	...do...	...do...	...do...	3	40	16.4	200	2,762	330	393	4.455	74.0	340.0	32.78	$6\frac{1}{4}$	28.88	2,620	80.0	14.46	149.8	.00727

[1] For conditions of cooking see Table 32.

[2] Commercial.

TABLE 17.—*Grinder run on tamarack*—Continued.

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*° F.*	
16	Steamed..	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same surface....	3	40	16.4	200	2,762	314	382	3.510	89.5	266.0	32.78	5½	28.88	2,638	80.5	16.70	150.2	0.00692
17	.....do.....	.....do..............	.....do..........	3	40	16.4	200	2,762	330	397	3.475	95.0	277.0	29.70	5¾	33.01	2,515	84.6	11.88	163.0	.00728
18	.....do.....	.....do..............	.....do..........	3	40	16.4	200	2,762	338	389	3.240	104.3	261.0	29.70	6	33.01	2,482	83.6	10.99	156.3	.00745
19	.....do.....	.....do..............	.....do..........	3	40	16.4	200	2,762	288	356	2.950	97.6	233.5	33.70	5¾	27.93	2,524	74.9	16.90	143.4	.00635
20	.....do.....	.....do..............	Stone dressed...	3	40	16.4	200	2,762	326	378	5.195	62.8	380.0	33.70	5¾	27.93	2,730	81.0	12.86	125.4	.00719
21	.....do.....	.....do..............	Same surface....	3	40	16.4	200	2,762	314	370	3.850	81.5	308.0	32.36	6⅜	28.04	2,500	77.3	16.40	141.8	.00692
22	.....do.....	.....do..............	.....do..........	3	40	16.4	200	2,762	295	349	3.035	97.2	274.0	32.36	6	28.04	2,218	68.5	11.60	143.6	.00650
23	.....do.....	.....do..............	.....do..........	3	40	16.4	200	2,762	291	361	3.480	83.7	309.0	32.36	5¾	28.04	2,250	69.5	16.90	132.0	.00647
24	.....do.....	.....do..............	.....do..........	3	40	16.4	200	2,762	348	435	5.050	68.9	378.0	32.36	5⅞	28.04	2,670	82.5	8.35	139.1	.00766
25	.....do.....	.....do..............	Same as No. 55 hemlock.	3	40	16.4	200	2,762	302	354	3.000	100.6	250.0	34.25	5⅞	25.32	2,398	70.0	16.88	141.5	.00661
26	....	.....do..............	Same as No. 56 hemlock.	3	30	12.3	225	3,085	302	343	1.898	159.2	144.8	33.29	5⅞	22.51	2,620	78.7	8.14	187.2	.00795
27	Steamed...	Spiral, cut 6 to inch.	Same as No. 6 California lodgepole.	2	40	16.4	250	3,427	288	326	4.780	60.3	384.0	31.47	5¾	25.58	2,490	79.0	16.10	103.6	.00512
28	...do......	.....do..............	Same surface....	2	55	22.55	201	2,760	283	311	4.420	64.0	366.0	31.47	5¾	25.58	2,412	76.5	18.42	113.0	.00455
29	...do......	.....do..............	.....do..........	2	70	28.7	179	2,458	280	310	4.350	64.4	368.0	31.47	5¾	25.58	2,360	75.0	22.30	117.8	.00397
30	...do......	.....do..............	.....do..........	2	85	34.8	158	2,165	289	322	3,912	73.9	330.0	31.47	5¾	25.58	2,365	75.1	28.65	108.3	.00383
31	...do......	.....do..............	.....do..........	2	100	41.0	136	1,868	278	311	3.840	72.4	314.0	31.47	6	25.58	2,442	77.6	30.35	113.0	.00364
32	...do......	Straight, cut 3 to inch; diamond point, 10 to inch.	Same as for No. 9 California lodgepole.	2	40	16.4	225	3,081	258	288	2.865	90.0	252	31.68	5½	24.54	2,275	71.7	9.70	127.1	.00510
33	...do......	.....do..............	Same surface....	2	60	24.65	225	3,081	360	408	4.270	84.3	363.0	31.68	5½	24.54	2,350	74.1	22.20	136.5	.00473
34	...do......	.....do..............	.....do..........	2	80	32.8	225	3,081	421	482	4.790	88.0	410.0	31.68	5⅞	24.54	2,338	73.6	36.70	128.5	.00417
35	Boiled....	.....do..............	.....do..........	2	40	16.4	225	3,081	272	300	2.530	107.6	206.5	31.68	6	24.54	2,450	77.3	15.47	134.7	.00538
36	...do......	.....do..............	.....do..........	2	60	24.65	225	3,081	382	420	4.670	81.9	381.0	31.68	6	24.54	2,450	77.3	18.30	142.5	.00502
37	...do......	.....do..............	Same as No. 41 tamarack.	2	80	32.8	225	3,081	438	499	4.565	95.8	385.0	31.47	6⅝	25.58	2,370	75.3	28.70	130.6	.00433

38	Steamed...	.....do.............	Same as No. 36 tamarack.	3	40	16.4	200	2,740	360	390	2.950	122.0	222.0	31.68	6¼	24.54	2,660	83.9	9.66	141.2	.00801
39	...do......	.....do.............	Same surface....	3	40	16.4	225	3,081	262	281	2.050	127.9	185.8	31.68	4⅝	24.54	2,208	69.6	17.60	142.3	.00518
40	...do......	.....do.............	.....do..........	3	60	24.65	225	3,081	351	395	3.795	92.5	330.0	31.68	4⅝	24.54	2,300	72.5	15.50	135.7	.00461
41	...do......	.....do.............	.....do..........	3	80	32.8	225	3,081	429	465	4.455	96.1	390.0	31.68	5½	24.54	2,290	72.3	18.40	129.8	.00424
42	Boiled....	Straight, cut 8 to inch.	Stone dressed...	3	40	16.4	225	3,080	224	280	1.675	133.8	164.0	30.72	5½	24.47	2,042	66.6	13.28	148.3	.00444
43	...do......	.....do.............	Same surface....	3	60	24.65	225	3,080	299	336	2.745	109.0	240.0	30.72	5½	24.47	2,285	74.5	15.07	133.4	.00394
44	...do......	.....do.............	Same as jack pine No. 28.	3	80	32.8	225	3,080	360	410	3.495	103.0	316.0	30.72	5¾	24.47	2,210	72.0	21.00	127.6	.00356
45	...do......	.....do.............	Same as jack pine No. 31.	3	60	24.65	225	3,080	308	346	2.975	103.7	274.0	30.40	5½	25.75	2,168	71.4	20.27	125.9	.00405
46	Boiled in salt brine.	.....do.............	Same surface....	3	60	24.65	225	3,080	312	337	3.265	95.5	264.5	33.14	5¾	24.34	2,465	74.5	14.36	136.9	.00410
47	Steamed...	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as jack pine No. 32.	3	60	24.65	200	2,732	422	471	1.459	290.0	128.0	32.75	6	23.62	2,280	69.6	10.79	177.3	.00626
48	...do......	.....do.............	Same as jack pine No. 34.	3	60	24.65	200	2,732	366	440	4.610	79.4	394.0	32.75	5½	23.62	2,338	71.4	24.9	108.3	.00543
49	....	.....do.............	Same surface....	3	60	24.65	150	2,049	352	406	5.400	65.2	426.0	32.75	5⅝	23.62	2,535	77.4	11.09	109.0	.00696
50[1]	....	....	....	....	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
51[1]	....	....	....	....	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
52[1]	....	....	....	....	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
53	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as for No. 23 green balsam.	3	40	16.4	225	3,069	430	505	4.510	95.4	324.0	32.44	5½	25.25	2,780	85.6	10.10	170.0	.00854
54[1]	....	....	....	....	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
55	Steamed...	Spiral, aut 8 to inch; straight, cut 10 to inch.	Stone dressed...	3	30	12.3	250	3,387	286	325	2.615	109.5	233.0	31.21	5½	25.20	2,245	72.0	13.50	144.0	.00686
56	...do......	.....do.............	Same surface....	3	35	14.3	221	2,990	288	352	2.755	104.5	234.0	31.21	5½	25.20	2,350	75.2	13.65	134.0	.00674
57	...do......	.....do.............	.....do..........	3	40	16.4	196	2,658	290	348	2.725	106.3	240.0	31.21	5½	25.20	2,275	72.8	14.40	150.0	.00665
58	...do......	.....do.............	.....do..........	3	45	18.4	167	2,262	285	329	2.535	112.5	220.0	31.21	5½	25.20	2,305	73.9	12.60	149.0	.00684
59	...do......	.....do.............	.....do..........	3	50	20.5	154	2,086	290	329	2.420	120.0	210.0	31.21	5½	25.20	2,300	73.6	9.50	155.0	.00677
60	...do......	.....do.............	.....do..........	3	55	22.5	153	2,075	286	353	2.500	114.3	220.0	31.21	5½	25.20	2,270	72.7	16.20	146.0	.00612
61	...do......	.....do.............	.....do..........	3	60	24.65	140	1,898	286	323	2.165	132.0	198.0	31.21	5½	25.20	2,186	70.1	11.50	155.0	.00611
62	...do......	.....do.............	Stone dressed...	2	40	16.4	250	3,387	269	312	3.315	81.2	298.0	31.21	5½	25.20	2,222	71.2	12.95	139.0	.00484
63	...do......	.....do.............	Same surface....	2	45	18.4	232	3,143	267	316	3.390	78.8	294.0	31.21	5½	25.20	2,305	73.9	9.65	145.0	.00461
64	...do......	.....do.............	.....do..........	2	50	20.5	225	3,049	273	324	3.385	80.6	288.0	31.21	5½	25.20	2,340	75.0	11.25	139.0	.00436
65	...do......	.....do.............	.....do..........	2	55	22.5	220	2,980	272	330	3.080	88.3	266.0	31.21	5½	25.20	2,320	74.3	10.50	146.0	.00405
66	...do......	.....do.............	.....do..........	2	60	24.65	201	2,722	272	335	2.880	94.5	247.0	31.21	5½	25.20	2,330	74.6	14.15	142.0	.00405
67	...do......	.....do.............	.....do..........	2	65	26.6	213	2,882	274	342	2.670	102.8	232.0	31.21	5½	25.20	2,302	73.8	12.30	141.0	.00357
68	...do......	.....do.............	.....do..........	2	70	28.7	190	2,575	272	351	2.745	99.1	233.0	31.21	5½	25.20	2,350	75.3	11.95	147.0	.00368
69	...do......	.....do.............	Same as No. 242 spruce.	2	60	24.65	225	3,049	334	380	5.010	66.6	458.0	32.46	5¼	28.64	2,190	67.5	19.70	136.0	.00444
70	...do......	Diamond point, 6 to inch.	Same surface....	2	60	24.65	222	3,008	333	382	4.710	70.7	434.0	32.46	5⅜	28.64	2,175	67.0	21.90	135.0	.00448
71	...do......	.....do.............	.....do..........	2	60	24.65	218	2,958	335	384	4.605	72.7	460.0	32.46	5⅜	28.64	2,000	61.6	19.40	137.0	.00460

[1] See runs on mixed woods.

TABLE 17.—*Grinder runs on tamarack*—Continued.

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Feet per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*° F.*	
72	Steamed..	Diamond point, 6 to inch.	Same surface....	2	60	24.65	220	2,981	335	399	4.370	76.7	386.0	32.46	5¼	28.64	2,260	69.6	27.20	133.0	0.00456
73	...do......	.....do..............	.....do..........	2	60	24.65	217	2,941	336	398	4.050	73.9	374.0	32.46	5⅝	28.64	2,435	75.0	27.30	137.0	.00463
74	...do......	.....do..............	.....do..........	2	60	24.65	205	2,780	333	391	4.490	74.2	360.0	32.46	5¼	28.64	2,490	76.7	23.30	137.0	.00486
75	...do......	.....do..............	.....do..........	2	60	24.65	197	2,673	335	388	4.775	70.1	372.0	32.46	4⅞	28.64	2,560	78.9	18.30	131.0	.00508
76	...do......	.....do..............	.....do..........	2	60	24.65	185	2,505	335	394	5.075	66.0	378.0	32.46	5	28.64	2,680	82.5	19.30	140.0	.00511
77	....	.....do..............	.....do..........	2	60	24.65	170	2,302	334	404	5.780	57.9	380.0	32.46	5¼	28.64	3,040	93.6	11.10	138.0	.00587
78	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 12 black gum.	2	40	16.40	175	2,348	216	276	1.320	163.6	119.0	30.88	6	33.60	2,215	71.7	11.4	164.0	.00561
[1] 79	....	.....do..............	Same surface....	2	40	16.40	175	2,348	195	258	1.020	191.0	102.0	29.37	10½	32.80	2,000	68.1	12.7	170.0	.00506
80	....	.....do..............	Stone dressed...	2	40	16.40	175	2,348	207	251	.560	370.0	63.0	30.88	7	33.60	1,770	57.4	8.8	174.0	.00538
[1] 81	....	.....do..............	Same surface....	2	40	16.40	175	2,348	202	245	.541	373.0	65.0	29.37	8½	32.80	1,672	57.0	15.9	175.0	.00524

[1] Wood for these runs partially decayed.

TABLE 18.—*Grinder runs on western larch.*

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	Steamed..	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as No. 8 Montana lodgepole.	3	40	16.4	200	2,762	321	374	2.730	117.6	282.0	30.12	7	37.64	1,937	64.3	14.40	157.7	0.00709
2	....	.....do...........	Same as for No. 9 Montana lodgepole.	3	30	12.3	225	3,085	334	378	3.220	103.6	338.0	27.94	7½	34.87	1,902	68.1	6.70	168.7	.00880
3	....	.....do...........	Stone dressed...	3	60	24.65	100	1,366	267	298	1.830	146.0	212.0	26.55	7	36.38	1,728	65.1	6.20	138.2	.00793
4	....	.....do...........	Same surface....	3	30	12.3	225	3,073	304	329	1.340	227.0	150.8	26.55	7	36.38	1,778	67.0	6.54	154.3	.00805
5	....	.....do...........	Same as No. 15 Sitka spruce.	3	60	24.65	225	3,073	508	595	2.725	186.3	329.0	26.55	7	36.38	1,657	62.4	7.27	166.5	.00670
6	....	.....do...........	Same surface....	3	40	16.4	175	2,390	303	344	1.086	279.0	115.0	26.55	7	36.38	1,887	71.1	5.80	177.9	.00772
7	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as 24 green balsam.	2	60	24.65	175	2,387	309	357	3.570	86.5	314.0	27.62	9⅜	40.28	2,270	82.1	12.85	149.0	.00525
8	....	.....do...........	Same surface....	2	40	16.4	225	3,069	304	342	2.525	120.1	227.0	27.62	8½	40.28	2,223	80.5	10.40	157.0	.00605
9	....	.....do...........	.....do.........	2	60	24.65	225	3,069	401	442	4.155	96.6	376.0	27.62	9¼	40.28	2,213	80.0	4.70	155.0	.00530
10	....	.....do...........	.....do.........	2	80	32.8	225	3,069	473	567	5.490	86.3	515.0	27.62	9⅝	40.28	2,125	77.0	12.35	142.0	.00470
11	....	.....do...........	.....do.........	2	80	32.8	175	2,387	382	456	4.355	87.6	406.0	27.62	7¼	40.28	2,142	77.5	9.90	146.0	.00487
12	....	.....do...........	.....do.........	2	80	32.8	125	1,705	307	348	3.445	89.1	312.0	27.62	7¾	40.28	2,206	79.9	10.90	154.0	.00549

[1] For conditions of cooking see Table 32.

TABLE 19.—*Grinder runs on Montana lodgepole pine.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*° F.*	
1	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for run No. 23 spruce.	3	40	16.4	175	2,442	337.0	383	2.710	124.3	247.8	27.20	$6\frac{1}{2}$	16.90	2,190	80.5	8.68	170.8	0.00840
2	....	.....do.........	Stone dressed...	3	20	8.2	225	3,122	233.0	263	2.210	105.3	216.0	25.00	7	32.60	2,040	81.6	13.70	157.4	.00910
3	....	.....do.........	Same surface....	3	40	16.4	225	3,122	412.0	453	5.940	69.4	553.0	25.00	$6\frac{7}{8}$	32.60	2,145	85.9	17.76	137.9	.00804
4	....	.....do.........	.....do.........	3	60	24.65	225	3,122	574.0	660	8.965	64.0	930.0	25.00	$7\frac{1}{8}$	32.60	1,930	77.1	25.80	148.0	.00745
5	....	.....do.........	.....do.........	3	20	8.2	175	2,428	183.6	208	1.700	108.0	159.6	26.10	$6\frac{3}{8}$	18.80	2,130	81.6	8.96	86.0	.00921
6	....	.....do.........	.....do.........	3	40	16.4	175	2,428	341.5	382	3.530	96.7	343.0	26.10	$6\frac{1}{2}$	18.80	2,060	78.9	7.69	89.6	.00856
7	....	.....do.........	.....do.........	3	60	24.65	175	2,428	482.5	545	5.465	88.2	511.0	26.10	$6\frac{3}{8}$	18.80	2,140	82.0	17.75	87.8	.00805
8	Steamed..	.....do.........	Same as yellow pine No. 3.	3	40	16.4	200	2,762	289.0	339	2.795	103.3	288.0	26.48	$6\frac{3}{8}$	19.52	1,942	73.4	22.73	148.3	.00638
9	....	.....do.........	Same as for western yellow pine No. 4.	3	30	12.3	225	3,085	318.0	356	2.795	113.7	223.0	26.57	$6\frac{3}{8}$	13.67	2,500	94.2	13.40	171.0	.00837
10	....	Straight, cut 3 to inch; spiral, cut 10 to inch.	Same as for western yellow pine run No. 7.	3	60	24.65	250	3,435	588.0	650	6.285	93.6	588.0	26.55	$6\frac{3}{8}$	15.22	2,135	80.4	11.66	150.9	.00695
11	....	.....do.........	Same surface....	3	40	16.4	250	3,435	424.0	476	3.375	125.7	303.0	26.55	$6\frac{5}{8}$	15.22	2,223	83.9	10.12	165.3	.00752
12	....	.....do.........	.....do.........	3	20	8.2	250	3,435	228.0	269	.964	237.0	92.0	26.55	$6\frac{5}{8}$	15.22	2,093	78.8	6.84	176.8	.00810
13	Boiled....	Straight, cut 8 to inch.	Same as No. 46 tamarack.	2	40	16.4	225	3,080	231.0	269	1.635	141.1	187.8	23.95	$6\frac{1}{2}$	24.90	1,741	72.8	17.06	140.7	.00457
14	...do......	.....do.........	Same surface....	2	60	24.65	225	3,080	320.0	356	2.500	128.0	270.0	23.95	$6\frac{1}{8}$	24.90	1,850	77.3	24.15	136.0	.00421
15	...do......	.....do.........	.....do.........	2	80	32.8	225	3,080	374.0	419	2.820	132.7	304.0	23.95	$6\frac{1}{8}$	24.90	1,850	77.3	20.50	129.9	.00370
16	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as No. 209 spruce.	3	60	24.65	100	1,367	251.0	295	2.612	96.1	241.0	24.70	7	24.80	2,170	87.9	16.59	127.1	.00745
17	....	.....do.........	Same surface....	3	60	24.65	150	2,049	375.0	428	3.670	102.2	334.0	24.70	7	24.80	2,195	88.9	13.59	124.4	.00741
18	....	.....do.........	.....do.........	3	60	24.65	200	2,732	486.0	536	4.395	110.7	406.0	24.70	7	24.80	2,160	87.5	16.62	135.0	.00722
19	....	.....do.........	.....do.........	3	60	24.65	250	3,415	599.0	676	5.650	106.0	530.0	24.70	$6\frac{3}{4}$	24.80	2,130	86.3	16.50	136.3	.00711
20	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 18 red fir.	2	40	16.4	225	3,069	263.0	308	2.040	129.0	195.0	23.40	$6\frac{1}{2}$	24.80	2,085	89.1	7.69	153.0	.00522

21	....	.....do............	Same surface....	2	60	24.65	225	3,069	360.0	409	2.655	135.7	256.0	23.40	$6\frac{7}{8}$	24.80	2,073	88.5	8.61	160.8	.00475
22	....	.....do............	.....do..........	2	80	32.8	225	3,069	441.0	513	4.340	101.8	423.0	23.40	$6\frac{1}{2}$	24.80	2,050	87.6	8.01	144.4	.00439
23	....	.....do............	.....do..........	2	100	41.0	225	3,069	510.0	596	5.390	94.9	515.0	23.40	$6\frac{3}{4}$	24.80	2,090	89.4	10.91	150.0	.00405
[2] 24	....	....	....	....	....	......	......	....	......	......	......	......	......	......	....	......	......	......	......	......	....
[2] 25	....	....	....	....	....	......	......	....	......	......	......	......	......	......	....	......	......	......	......	......	....
26	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	.....do..........	3	55	22.55	225	3,069	500.0	581	3.630	137.8	334.0	24.61	$6\frac{1}{2}$	25.00	2,175	88.3	12.20	173.0	.00723

[1] For conditions of cooking see Table 32.

[2] See runs on mixtures of woods.

TABLE 20.—*Grinder runs on California lodgepole pine.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood, bone-dry.	Average temperature of grinding.	Horsepower divided by pressure×speed.
					Lbs. per sq. in.	Lbs.		Ft. per minute.			Tons.		Cu. ft.	Lbs.	Inches.	P. ct.	Lbs.	P. ct.	Lbs.	°F.	
1	Steamed	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as larch No. 1.	3	40	16.4	200	2,762	312	358	2.515	124.2	329.5	24.74	6¾	22.78	1,526	61.7	16.86	155.3	0.00689
2		do	Same as western hemlock No. 1.	3	30	12.3	225	3,085	326	364	2.370	137.6	227	25.38	(2)	11.00	2,082	82.2	11.30	172.1	.00859
3		do	Same as spruce No. 154.	2	80	32.8	225	3,085	513	555	4.930	104.0	524	23.58	(2)	28.04	1,882	79.9	23.44	157.7	.00506
4		Spiral, cut 6 to inch	Same as for spruce No. 191.	3	20	8.2	175	2,400	193	222	1.661	116.2	161	25.35	(2)	10.93	2,062	81.5	11.57	142.1	.00980
5		do	Same surface	3	40	16.4	175	2,400	357	391	4.230	84.4	432	25.35	(2)	10.93	1,960	77.4	15.90	121.6	.00907
6		do	do	3	60	24.65	175	2,400	474	505	7.150	66.2	761	25.35	(2)	10.93	1,880	74.2	17.67	108.1	.00800
7		Straight, cut 3 to inch; diamond point, 10 to inch.	Stone dressed	3	20	8.2	225	3,081	228	264	1.475	154.6	164	25.35	(2)	10.93	1,800	71.0	7.99	144.5	.00902
8		do	Same surface	3	40	16.4	225	3,081	392	444	3.245	121.0	344	25.35	(2)	10.93	1,886	74.4	7.95	149.2	.00775
9		do	do	3	60	24.65	225	3,081	579	651	6.400	90.5	695	25.35	(2)	10.93	1,842	72.7	21.00	114.4	.00760
10		Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	3	60	24.65	100	1,366	264	323	1.140	232.0	124.4	22.29	(2)	22.33	1,832	82.2	12.49	152.7	.00784
11		do	Same surface	3	60	24.65	150	2,049	374	430	1.745	214.0	196	22.29	(2)	22.33	1,776	79.5	12.22	161.1	.00740
12		do	do	3	60	24.65	200	2,732	512	594	2.055	249.0	253	22.29	(2)	22.33	1,623	72.9	13.17	168.8	.00760
13		do	do	3	60	24.65	250	3,415	540	630	2.595	208.0	294	22.29	(2)	22.33	1,763	79.1	13.40	164.8	.00641
14		do	Stone dressed	2	20	8.2	225	3,073	126	157	.504	250.0	59	22.67	(2)	24.67	1,707	75.1	5.88	139.9	.00500
15		do	Same surface	2	40	16.4	225	3,073	270	301	1.675	161.2	178	22.67	(2)	24.67	1,878	82.7	7.50	164.0	.00535
16		do	do	2	60	24.65	225	3,073	358	402	2.675	134.0	296	22.67	(2)	24.67	1,810	79.8	6.97	149.7	.00473
17		do	do	2	80	32.8	225	3,073	439	508	3.725	117.4	386	22.67	(2)	24.67	1,930	85.0	10.60	139.6	.00435
18		do	do	2	100	41.0	225	3,073	577	655	4.975	116.0	531	22.67	(2)	24.67	1,872	82.5	6.87	151.5	.00458
19		Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 23 Montana lodgepole.	2	40	16.4	225	3,069	259	307	1.081	239.5	111	23.05	(2)	26.05	1,952	84.6	7.05	175.6	.00514
20		do	Same surface	2	60	24.65	225	3,069	347	410	1.763	196.7	184	23.05	(2)	26.05	1,921	83.4	9.65	168.0	.00459
21		do	do	2	80	32.8	225	3,069	409	465	2.925	139.6	303	23.05	(2)	26.05	1,932	83.8	10.15	165.1	.00405

[3] 22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
[3] 23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
[3] 24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
[3] 25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
26	...	...do...	Same as for No. 22 green balsam.	2	80	32.8	225	3,069	496	580	6.405	77.5	642	22.45	([2])	25.30	1,996	88.9	21.6	156.0	.00492

[1] For conditions of cooking see Table 32.

[2] Split wood.

[3] For runs 22 to 25, inclusive, see runs on mixed woods.

TABLE 21.—*Grinder runs on western yellow pine.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	Steamed..	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as hemlock No. 53.	3	40	16.4	200	2,768	376	422	4.100	91.7	486.0	23.50	[2] 7	44.27	1,688	71.8	40.30	121.1	0.00828
2	Boiled....	.....do..........	Same as hemlock No. 54.	3	40	16.4	200	2,762	307	356	4.020	76.4	368.0	23.65	[2] 8¼	54.54	2,182	92.3	26.05	124.7	.00677
3	Steamed..	.....do..........	Stone dressed....	3	40	16.4	200	2,762	326	394	4.400	74.1	392.0	28.24	10	43.83	2,243	79.2	34.10	129.2	.00719
4	....	.....do..........	Same as spruce No. 151.	3	30	12.3	225	3,085	337	386	3.255	103.7	313.0	25.11	9½	16.53	2,080	82.9	10.78	166.0	.00888
5	....	.....do..........	Stone dressed...	3	60	24.65	250	3,435	580	661	6.620	87.6	610.0	26.55	9⅛	24.15	2,170	81.8	15.42	157.5	.00685
6	....	.....do..........	Same surface....	3	40	16.4	250	3,435	466	511	4.850	96.0	436.0	26.55	10	24.15	2,222	83.8	8.54	156.9	.00829
7	....	.....do..........	.....do..........	2	80	32.8	150	2,056	356	393	5.100	69.8	489.0	26.55	9¾	24.15	2,085	78.5	27.60	134.1	.00528
8	Boiled....	Straight, cut 8 to inch.	Same as No. 7 Sitka spruce.	2	40	16.4	225	3,080	244	259	1.620	150.7	219.0	22.50	9⅛	23.40	1,480	65.8	14.92	129.6	.00483
9	...do......	.....do..........	Same surface....	2	60	24.65	225	3,080	317	341	2.865	110.7	326.0	22.50	9⅛	23.40	1,757	78.0	29.20	109.4	.00417
10	...do......	.....do..........	.....do..........	2	80	32.8	225	3,080	370	401	3.075	120.2	384.0	22.50	8¾	23.40	1,603	71.4	39.60	116.5	.00366
11	Steamed..	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as No. 10 western hemlock.	3	40	16.4	200	2,732	320	397	1.011	316.0	114.3	24.25	8¼	23.09	1,770	73.0	21.20	165.3	.00715
12	....	.....do..........	Same as No. 19 Montana lodgepole.	3	60	24.65	100	1,366	269	300	2.630	102.3	275.0	23.97	10⅜	22.31	1,912	79.9	26.64	105.0	.00799
13	....	.....do..........	Same surface....	3	60	24.65	150	2,049	403	437	2.912	138.2	301.0	23.97	8⅝	22.31	1,936	80.9	27.65	122.4	.00796
14	....	.....do..........	.....do..........	3	60	24.65	200	2,732	529	580	3.777	140.0	392.0	23.97	9¼	22.31	1,930	80.6	24.07	123.9	.00784
15	....	.....do..........	.....do..........	3	60	24.65	250	3,415	654	726	4.860	134.6	501.0	23.97	8¼	22.31	1,940	81.0	17.60	147.1	.00776
16	....	.....do..........	Stone dressed...	2	40	16.4	225	3,069	290	338	2.533	114.3	255.0	22.90	9⅜	28.65	1,990	86.9	8.37	150.8	.00576
17	....	.....do..........	Same surface....	2	60	24.65	225	3,069	410	470	5.050	81.2	479.0	22.90	9¼	28.65	2,105	92.0	12.68	143.0	.00541
18	....	.....do..........	.....do..........	2	80	32.8	225	3,069	434	496	6.595	65.9	616.0	22.90	9⅜	28.65	2,140	93.4	12.69	123.8	.00431
19	....	.....do..........	.....do..........	2	100	41.0	225	3,069	513	577	8.150	62.9	739.0	22.90	9⅞	28.65	2,065	90.2	22.30	125.6	.00407
[3] 20	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
[3] 21	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
[3] 22	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
[3] 23	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
[3] 24	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

[3] 25	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
[3] 26	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
27	....	Straight, cut 10 to inch; spiral, cut 8 to inch.	Stone dressed...	3	40	16.4	225	3,069	455	541	7.055	64.5	635.0	24.67	10¾	26.98	2,220	90.0	30.20	137.0	.00904

[1] For conditions of cooking see Table 32.

[2] Wood was in 1-foot lengths.

[3] See runs on mixture of woods.

TABLE 22.—*Grinder runs on jack pine.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure×speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1		Natural surface		3	20.0	8.2	151.0	2,100												140.0	
2		do		3	30.0	12.3	151.0	2,100												147.0	
3		do		3	39.0	16.0	150.0	2,090												176.0	
3-1		do		3	39.3	16.1	151.0	2,100												176.0	
4		do		3	50.0	20.5	150.6	2,100	[2] 350.0											196.0	
5		do		3	60.0	24.65	151.0	2,100	[2] 329.0											199.0	
6		do		3	60.0	24.65	171.0	2,380	[2] 324.0											196.0	
6-1		do		3	60.0	24.65	171.0	2,370												201.0	
7		do		3	50.0	20.5	171.0	2,370	[2] 240.0											199.0	
7-1		do	Stone dressed	3	50.0	20.5	172.0	2,380	256.0		1.305	196.2	143.0	25.27		47.95	1,820	72.0		197.0	
7-2		do		3	50.0	20.5	172.0	2,380	245.0		1.263	193.6	117.6	25.57		48.90	2,150	84.1		183.0	
8		do		3	60.0	24.65	203.0	2,810												198.0	
8-1		do	do	3	60.0	24.65	203.0	2,810												191.0	
9		do		3	50.0	20.5	202.0	2,800												205.0	
10		do		3	75.0	30.8	202.0	2,800												185.0	
11		Diamond point, cut 6 to inch.	do	3	60.0	24.65	152.5	2,100	380.5											148.0	
11-1		do		3	60.0	24.65	154.0	2,100	360.5		6.075	59.3								146.0	
12		do	Same as for No. 11.	3	50.0	20.5	152.5	2,100	350.0		5.225	67.0								145.0	
12-1		do	Same as for No. 22.	3	50.0	20.5	154.0	2,100	359.0		7.030	51.0								179.0	
13		do	Stone dressed	3	40.0	16.4	152.5	2,100	260.0		3.028	85.9								138.2	
13-1		do	do	3	40.0	16.4	153.5	2,100	299.0		2.670	112.0								195.0	
14		do	Same as for No. 13.	3	50.0	20.5	173.0	2,380	324.0		4.716	68.8								154.0	
14-1		do	Stone dressed	3	50.0	20.5	174.0	2,380	398.0		5.046	78.8								166.0	
15		do	do	3	60.0	24.65	173.0	2,380	395.5		6.390	61.8								138.0	
15-1		do	Same as for No. 14-1.	3	60.0	24.65	174.0	2,380	461.0		5.500	83.8								158.0	
16		do	Stone dressed	3	40.0	16.4	203.5	2,800	362.5		5.450	66.4								147.0	
16-1		do	Same as for No. 18-1.	3	40.0	16.4	205.0	2,800	375.0		5.360	70.0								200.0	

17		do	Stone dressed	3	40.0	16.4	173.0	2,380	279.0		3.834	75.5								143.0	
17–1		do	Same as for No. 18–1.	3	40.0	16.4	174.0	2,380	332.0		4.350	76.3								178.0	
18		do	Stone dressed	3	50.0	20.5	204.0	2,800	407.5		6.910	59.0								143.0	
18–1		do	do	3	50.0	20.5	205.0	2,800	414.0		6.360	65.0								193.0	
19		do	do	3	30.0	12.3	152.5	2,100	201.0		2.045	98.3								149.0	
20		do	do	3	30.0	12.3	205.0	2,800	313.0		5,320	58.8								178.0	
20–1		do	Same as for No. 22.	3	30.0	12.3	205.0	2,800	304.0		3.620	83.8	305.5	24.90		50.00	2,370	95.1		198.0	
21		do	Same as for No. 20.	3	30.0	12.3	174.0	2,380	269.5		4.810	56.0								172.0	
22		do	Stone dressed	3	60.0	24.65	205.0	2,800	481.0		7.320	65.8								185.0	
23		do	Same as for No. 18–1.	3	40.0	16.4	205.0	2,800	249.0		4.110	84.9								206.0	
24		Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for commercial No. 51, hemlock.	3	40.0 45.0	16.4 18.46	175.0	2,445	395.0	469	4.305	91.8	388.0	25.60		37.16	2,220	86.7	14.86	176.3	0.00924
25	Steamed	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed	3	40.0	16.4	200.0	2,768	370.0	455	5.100	72.5	479.0	24.96	6½	44.49	2,130	85.5	25.27	130.3	.00815
26	do	do	Same as No. 7 balsam.	3	40.0	16.4	200.0	2,762	331.0	376	2.990	110.8	339.0	24.16	5⅝	43.20	1,762	73.1	12.66	151.8	.00730
27		do	Same as for spruce No. 152.	3	30.0	12.3	225.0	3,085	337.0	380	2.255	149.7	219.0	25.70	5⅞	29.30	2,060	80.1	7.31	179.2	.00888
28	Boiled	Straight, cut 8 to inch.	Same as No. 43 tamarack.	2	40.0	16.4	225.0	3,080	243.0	272	1.646	147.8	209.3	23.46	5⅞	37.51	1,572	67.0	11.63	146.2	.00481
29	do	do	Same as No. 44 tamarack.	2	60.0	24.65	225.0	3,080	323.0	358	2.650	122.0	334.0	23.46	6¾	37.51	1,583	67.5	15.30	141.4	.00425
30	do	do	Same surface	2	80.0	32.8	225.0	3,080	363.0	411	3.095	117.3	402.0	23.46	6¾	37.51	1,539	65.5	22.58	125.0	.00360
31	do	do	Same as No. 10 western yellow pine.	2	60.0	24.65	225.0	3,080	322.0	352	2.650	121.4	339.0	22.97	6⅝	39.10	1,565	68.2	14.75	108.1	.00424
32	Steamed	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as No. 11 western yellow pine.	3	60.0	24.65	200.0	2,732	449.0	516	1.830	245.0	201.0	22.80	6¼	36.60	1,820	79.8	12.26	165.8	.00666
33	do	do	Stone dressed	3	60.0	24.65	200.0	2,732	371.0	430	4.225	87.8	540.0	22.80	5¾	36.60	1,567	68.6	28.40	103.3	.00550
34		do	Same surface	3	60.0	24.65	155.0	2,118	357.0	462	5.390	66.3	587.0	22.80	5¾	36.60	1,832	80.4	11.70	99.2	.00684

[1] For conditions of cooking see Table 32.

[2] Approximate.

TABLE 23.—*Grinder runs on loblolly pine.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton, bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet, solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet, solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
		Fall-cut wood.			*Lbs. per sq. in.*	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*° F.*	
1	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Stone dressed...	2	40	16.40	175	2,348	225	248	2.430	92.5	201	28.56	....	20.20	2,380	83.4	15.3	150	0.00581
2	....	.....do...........	Same surface....	2	60	24.65	175	2,348	314	367	3.830	81.7	337	28.56	....	20.20	2,280	79.9	12.5	136	.00541
6	....	.....do...........	Same as No. 5...	2	80	32.80	175	2,348	368	419	3.195	115.0	260	28.56	....	20.20	2,460	86.2	14.1	156	.00478
7	....	.....do...........	Same surface....	2	60	24.65	175	2,348	318	350	2.455	129.5	196	28.56	....	20.20	2,500	87.6	15.5	156	.00549
8	....	.....do...........	.....do........	2	40	16.40	175	2,348	226	264	1.165	194.0	99	28.56	....	20.20	2,350	82.4	8.7	169	.00587
13	....	.....do...........	Stone dressed...	2	60	24.65	100	1,342	209	250	2.225	93.8	179	28.56	....	20.20	2,490	87.3	12.4	150	.00631
14	....	.....do...........	Same surface....	2	60	24.65	150	2,013	296	332	3.140	94.2	247	28.56	....	20.20	2,540	89.0	13.2	147	.00597
15	....	.....do...........	.....do........	2	60	24.65	250	3,355	430	489	4.865	88.3	404	28.56	....	20.20	2,410	84.5	12.0	146	.00520
19	Steamed..	.....do...........	Same as No. 18..	2	80	32.80	225	3,020	397	465	3.400	116.9	343	28.56	....	20.20	1,990	69.8	19.4	145	.00401
23	....	.....do...........	Same as No. 15, amabilis fir.	2	40	16.40	175	2,348	198	251	1.772	111.0	145	29.52	....	16.80	2,445	82.9	22.8	149	.00513
24	....	.....do...........	Same as No. 23..	2	60	24.65	175	2,348	302	362	3.305	91.3	262	29.52	....	16.80	2,520	85.4	22.7	149	.00521
25	....	.....do...........	Same as No. 24..	2	80	32.80	175	2,348	371	413	4.350	85.2	347	29.52	....	16.80	2,510	85.0	17.4	143	.00481
[2] 29	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as No. 279, spruce.	2	20	8.20	200	2,774	129	150	1.800	71.6	123	29.52	....	16.80	2,930	......	17.7	129	.00568
		Spring-cut wood.																			
3	....	Spiral, cut 3 to inch; straight, cut 10 to inch.	Stone dressed...	2	40	16.40	175	2,348	220	278	1.585	138.5	143	27.56	....	23.62	2,220	80.6	8.8	158	.00571
4	....	.....do...........	Same as No. 3...	2	60	24.65	175	2,348	307	367	2.490	123.3	214	27.56	....	23.62	2,320	84.2	14.9	157	.00530
5	....	.....do...........	Same surface....	2	80	32.80	175	2,348	366	437	3.375	108.5	280	27.56	....	23.62	2,415	87.6	14.4	146	.00475
9	....	.....do...........	Same as No. 8...	2	60	24.65	100	1,342	208	250	1.590	131.0	133	27.56	....	23.62	2,390	86.8	9.6	160	.00629
10	....	.....do...........	Same surface....	2	60	24.65	150	2,013	282	313	1.960	144.0	159	27.56	....	23.62	2,460	89.3	8.5	156	.00569
11	....	.....do...........	.....do........	2	60	24.65	200	2,684	352	426	1.945	181.0	169	27.56	....	23.62	2,300	83.5	9.9	170	.00531
12	....	.....do...........	.....do........	2	60	24.65	250	3,355	390	464	2.225	175.2	196	27.56	....	23.62	2,276	82.6	12.1	168	.00471
16	Steamed..	.....do...........	Same as No. 15..	2	40	16.40	225	3,020	214	318	2.015	121.0	202	27.56	....	23.62	2,000	72.6	15.4	142	.00494
17	...do.....	.....do...........	Same surface....	2	60	24.65	225	3,020	333	372	2.800	119.0	276	27.56	....	23.62	2,025	73.5	13.5	139	.00446
18	...do.....	.....do...........	.....do........	2	80	32.80	225	3,020	410	481	3.865	106.0	370	27.56	....	23.62	2,090	75.9	22.9	139	.00415

20	...do......	.....do..............	Same as No. 19..	2	60	24.65	225	3,020	367	438	3.005	122.0	261	27.56	....	23.62	2,300	83.5	28.0	143	.00493
21	....	.....do..............	Same surface....	2	60	24.65	225	3,020	419	475	3.690	113.3	310	27.56	....	23.62	2,380	86.4	11.7	146	.00563
22	....	.....do..............	Same as No. 13, noble fir.	2	60	24.65	175	2,348	290	327	4.225	68.8	368	27.89	....	25.19	2,300	82.5	17.6	129	.00501
26	....	.....do..............	Same as No. 25..	2	40	16.40	175	2,348	205	267	1.955	104.8	171	27.38	....	24.07	2,280	83.3	22.3	152	.00532
27	....	.....do..............	Same as No. 26..	2	60	24.65	175	2,348	296	342	2.900	102.0	254	27.38	....	24.07	2,280	83.3	18.2	145	.00511
28	....	.....do..............	Same as No. 27..	2	80	32.80	175	2,348	374	427	3.500	106.8	312	27.38	....	24.07	2,240	81.9	28.7	155	.00485

[1] For conditions of cooking see Table 32.

[2] No. 29 was run on a coarse-grit stone.

TABLE 24.—*Grinder runs on white pine.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu.ft.*	*Lbs.*	*Inches.*	*P.ct.*	*Lbs.*	*P.ct.*	*Lbs.*	*°F.*	
1	....	Diamond point, 6 to inch.	Same as No. 26 white fir.	2	40	16.4	175	2,372	248	305	2.035	122.0	218	20.40	5¼	61.74	1,870	91.7	4.4	150	0.00638
2	....	....do....	Same surface....	2	60	24.65	175	2,372	347	391	3.427	101.0	373	20.40	5½	61.74	1,840	90.2	8.8	139	.00594
3	....	....do....	....do....	2	80	32.8	175	2,372	451	489	5.010	90.0	534	20.40	6⅝	61.74	1,880	92.1	11.2	142	.00581
4	....	....do....	....do....	2	100	41.0	175	2,372	527	586	6.860	76.9	742	20.40	6½	61.74	1,850	90.7	10.0	133	.00543
5	....	....do....	....do....	2	60	24.65	100	1,355	226	250	2.035	111.0	211	20.40	5½	61.74	1,930	94.6	11.6	144	.00676
6	....	....do....	....do....	2	60	24.65	150	2,033	329	362	3.175	103.7	350	20.40	5¼	61.74	1,812	89.0	7.6	146	.00656
7	....	....do....	....do....	2	60	24.65	200	2,710	458	491	4.670	98.1	480	20.40	5⅞	61.74	1,947	95.5	6.7	147	.00685
8	....	....do....	....do....	2	60	24.65	250	3,388	496	536	5.200	95.5	532	20.40	5½	61.74	1,952	95.8	6.7	145	.00591
9	Steamed..	....do....	Same as No. 34 white fir.	2	40	16.4	225	3,049	302	354	2.330	129.7	318	20.10	5½	57.20	1,470	73.1	9.8	153	.00604
10	...do....	....do....	Same surface....	2	60	24.65	225	3,049	400	456	3.600	111.0	489	20.10	5½	57.20	1,470	73.1	15.4	153	.00531
11	...do....	....do....	....do....	2	80	32.8	225	3,049	460	531	4.245	108.4	552	20.10	5½	57.20	1,535	76.4	22.15	139	.00460
12	...do....	....do....	....do....	2	100	41.0	225	3,049	517	573	4.675	110.7	669	20.10	5½	57.20	1,400	69.6	30.6	138	.00414

[1] For conditions of steaming see Table 32.

Table 25.—*Grinder runs on Engelmann spruce (Montana).*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*° F.*	
1	....	Spiral, cut 12 to inch; straight, cut 3 to inch.	Same as No. 12 Alpine fir.	2	60	24.65	100	1,355	216	264	2.730	79.1	246	24.90	9½	44.00	2,220	89.1	13.4	137	0.00646
2	....	.....do..........	Same surface....	2	60	24.65	150	2,033	283	328	4.260	66.4	368	24.90	9	44.00	2,315	92.9	12.5	132	.00565
3	....	.....do..........	.....do..........	2	60	24.65	200	2,710	381	446	5.640	67.6	486	24.90	8⅞	44.00	2,315	92.9	16.4	129	.00570
4	....	.....do..........	.....do..........	2	60	24.65	250	3,388	455	539	7.050	64.5	611	24.90	9¼	44.00	2,300	92.4	9.4	130	.00545
5	....	.....do..........	.....do..........	2	40	16.40	225	3,049	281	333	3.695	76.1	328	24.90	9	44.00	2,255	90.5	4.2	135	.00666
6	....	.....do..........	.....do..........	2	60	24.65	225	3,049	422	461	6.140	67.3	554	24.90	9	44.00	2,220	89.1	8.5	134	.00561
7	....	.....do..........	.....do..........	2	80	32.80	225	3,049	484	534	9.280	52.2	770	24.90	8½	44.00	2,413	96.8	16.5	124	.00534
8	Steamed..	.....do..........	Stone dressed...	2	40	16.40	175	2,371	203	233	2.580	78.7	252	24.90	10¼	44.00	2,050	82.4	20.2	122	.00522
9	...do......	.....do..........	Same surface....	2	60	24.65	175	2,371	278	332	3.500	79.5	328	24.90	10	44.00	2,130	85.5	48.2	114	.00475
10	...do......	.....do..........	.....do..........	2	80	32.80	175	2,371	326	378	4.565	71.3	476	24.90	8⅛	44.00	1,915	76.9	104.0	113	.00420
11	....	.....do..........	.....do..........	2	40	16.40	175	2,371	240	278	3.645	65.9	302	24.90	9½	44.00	2,405	96.6	9.7	132	.00618
12	....	.....do..........	.....do..........	2	60	24.65	175	2,371	330	365	5.655	58.5	491	24.90	9½	44.00	2,290	92.0	19.1	128	.00565
13	....	.....do..........	.....do..........	2	80	32.80	175	2,371	399	450	6.880	58.0	651	24.90	10	44.00	2,110	84.8	26.5	120	.00514
14	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 10 lowland fir.	2	40	16.40	175	2,348	204	228	2.370	86.0	222	23.86	8	46.79	2,140	89.7	4.5	137	.00530
15	....	.....do..........	Same surface....	2	60	24.65	175	2,348	294	331	4.000	73.5	360	23.86	8	46.79	2,220	93.1	10.7	130	.00507
16	....	.....do..........	.....do..........	2	80	32.80	175	2,348	313	354	4.840	64.6	402	23.86	8½	46.79	2,405	10.08	12.9	131	.00406
17	....	.....do..........	.....do..........	2	60	24.65	100	1,342	187	201	2.525	74.0	223	23.86	10	46.79	2,275	95.4	11.3	136	.00564
18	....	.....do..........	.....do..........	2	60	24.65	150	2,013	259	303	3.380	76.6	306	23.86	7¼	46.79	2,215	92.9	7.8	136	.00522
19	....	.....do..........	.....do..........	2	60	24.65	200	2,684	333	370	4.880	68.3	437	23.86	7¾	46.79	2,230	93.5	4.3	131	.00503

[1] For conditions of cooking see Table 32.

TABLE 26.—*Grinder runs on Engelmann spruce (Colorado).*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone dry.	Average temperature of grinding.	Horsepower divided by pressure×speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 54 tamarack.	2	40	16.4	225	3,069	299	348	2.700	110.8	272	20.48	5 7/8	59.20	1,980	96.5	12.35	140	0.00594
2	....	.....do............	Same surface....	2	60	24.65	225	3,069	411	457	4.535	90.6	465	20.48	5 7/8	59.20	1,951	95.2	13.30	136	.00543
3	....	.....do............	.....do..........	2	80	32.8	225	3,069	478	538	5.600	85.4	577	20.48	5 7/8	50.20	1,940	94.6	16.20	150	.00475
4	....	.....do............	Same as No. 3 white fir.	2	60	24.65	175	2,387	323	358	3.230	100.0	343	20.48	5 1/4	59.20	1,882	91.9	13.30	144	.00548
5	....	.....do............	Same as No. 29 balsam.	3	60	24.65	100	1,355	257	300	3.325	77.3	310	22.22	6	57.30	2,150	96.7	11.10	137	.00769
6	....	.....do............	Same surface....	3	60	24.65	150	2,033	383	444	4.735	80.9	457	22.22	6	57.30	2,073	93.2	10.80	133	.00765
7	....	.....do............	.....do..........	3	60	24.65	200	2,710	510	589	6.535	78.1	662	22.22	6	57.30	1,972	88.8	6.70	138	.00763
8	....	.....do............	.....do..........	3	60	24.65	250	3,388	560	665	7.360	76.1	760	22.22	6	57.30	1,940	87.3	6.60	132	.00670
9	....	.....do............	Same as No. 7 white fir.	2	40	16.4	175	2,372	231	263	2.555	90.4	243	21.17	6	58.26	2,105	99.5	6.8	140	.00595
10	....	.....do............	Same surface....	2	60	24.65	175	2,372	304	362	4.075	74.6	383	21.17	6 3/8	58.26	2,127	......	8.9	136	.00520
11	....	.....do............	.....do..........	2	80	32.8	175	2,372	339	420	4.745	71.5	438	21.17	6 3/4	58.26	2,165	......	11.4	131	.00436
12	....	.....do............	.....do..........	2	100	41.0	175	2,372	416	493	6.215	67.0	598	21.17	6 1/4	58.26	2,080	98.4	9.7	139	.00428
13	Steamed..	.....do............	.....do..........	2	40	16.4	212	2,870	235	280	2.117	111.0	264	21.17	6 3/4	58.26	1,603	75.9	17.2	132	.00499
14	...do......	.....do............	.....do..........	2	60	24.65	223	3,020	308	377	3.160	97.4	334	21.17	6	58.26	1,890	89.4	19.2	132	.00413
15	...do......	.....do............	.....do..........	2	80	32.8	207	2,805	341	411	3.590	95.0	395	21.17	6 1/4	58.26	1,820	86.0	24.2	122	.00370
16	...do......	.....do............	.....do..........	2	100	41.0	222	3,007	414	490	4.525	91.4	525	21.17	6 1/2	58.26	1,722	81.5	23.8	129	.00336
17	...do......	.....do............	.....do..........	2	60	24.65	200	2,710	306	350	3.125	97.8	348	21.17	6 3/4	58.26	1,792	84.8	15.7	129	.00458
18	...do......	.....do............	.....do..........	2	60	24.65	195	2,642	307	372	3.560	86.3	375	21.17	6 1/2	58.26	1,900	89.8	15.3	126	.00470
19	....	.....do............	Same as No. 35 white fir.	2	70	28.70	225	3,020	368	479	4.840	76.0	488	21.17	6 1/2	58.26	1,980	93.6	12.8	153	.00425

[1] For cooking conditions see Table 32.

TABLE 27.—*Grinder runs on Sitka spruce.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for western larch No. 2.	3	30	12.3	225	3,085	307	358	2.225	137.8	214.5	25.38	(2)	16.66	2,075	81.8	12.88	174.2	0.00809
2	....	.....do...........	Stone dressed...	3	20	8.2	250	3,427	217	245	1.840	118.0	188.4	24.60	(2)	19.07	1,952	79.4	8.59	154.0	.00772
3	....	.....do...........	Same surface....	3	40	16.4	250	3,427	368	407	4.550	81.0	435.0	24.60	(2)	19.07	2,095	85.1	13.87	145.3	.00654
4	....	.....do...........	.....do.........	3	60	24.65	250	3,427	510	586	7.050	72.4	680.0	24.60	(2)	19.07	2,075	84.3	13.48	136.3	.00602
5	Boiled....	Straight, cut 8 to inch.	Same as No. 5 birch.	2	40	16.4	225	3,080	197	245	1.500	131.2	164.0	23.60	(2)	24.00	1,830	77.5	20.30	107.0	.00390
6	...do......	.....do...........	Same surface....	2	60	24.65	225	3,080	256	329	1.985	129.0	234.0	23.60	(2)	24.00	1,698	71.9	36.00	109.0	.00337
7	...do......	.....do...........	.....do.........	2	80	32.8	225	3,080	331	404	2.920	113.3	333.0	23.60	(2)	24.00	1,750	74.1	44.20	103.1	.00328
8	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed...	3	60	24.65	100	1,366	263	313	2.095	125.7	208.0	23.40	(2)	22.60	2,003	85.7	14.37	134.9	.00780
9	....	.....do...........	Same surface....	3	60	24.65	150	2,049	346	401	3.107	111.2	296.0	23.40	(2)	22.60	2,100	89.7	13.51	147.2	.00685
10	....	.....do...........	.....do.........	3	60	24.65	200	2,732	468	505	4.340	108.0	407.0	23.40	(2)	22.60	2,130	91.0	16.70	144.0	.00695
11	....	.....do...........	.....do.........	3	60	24.65	250	3,415	560	651	5.340	105.0	494.0	23.40	(2)	22.60	2,160	92.3	13.17	142.9	.00665
12	....	.....do...........	Same as No. 18 California lodgepole.	2	40	16.4	225	3,073	222	280	1.047	212.0	104.0	23.00	(2)	22.60	2,008	87.4	12.70	155.8	.00440
13	....	.....do...........	Same surface....	2	60	24.65	225	3,073	313	414	2.005	156.0	200.0	23.00	(2)	22.60	2,000	87.0	10.60	155.0	.00413
14	....	.....do...........	.....do.........	2	80	32.8	225	3,073	409	512	2.917	140.2	292.0	23.00	(2)	22.60	1,992	86.6	20.70	149.3	.00405
15	....	.....do...........	.....do.........	2	100	41.0	225	3,073	433	515	3.005	144.0	310.0	23.00	(2)	22.60	1,945	84.5	16.29	154.3	.00344
16	Steamed..	.....do...........	Same as No. 47 tamarack.	3	60	24.65	200	2,732	414	493	1.107	374.0	126.7	23.00	(2)	22.60	1,750	76.1	28.83	178.4	.00614
17	...do......	.....do...........	Same surface....	3	60	24.65	200	2,732	382	454	1.592	240.0	197.0	23.00	(2)	22.60	1,618	70.3	31.27	138.3	.00566
18	....	.....do...........	.....do.........	3	60	24.65	189	2,580	368	432	.920	400.0	94.2	23.00	(2)	22.60	1,952	84.9	18.50	176.7	.00578
19	....	.....do...........	Stone dressed...	2	80	32.8	225	3,069	458	541	4.495	102.0	435.0	23.00	(2)	22.60	2,065	89.9	32.50	166.0	.00455

[1] For cooking conditions see Table 32.

[2] Split wood.

TABLE 28.—*Grinder runs on white birch.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*° F.*	
1	Steamed..	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as for tamarack No. 25.	3	40	16.4	200	2,762	229.0	285	3.455	66.3	268.0	36.37	5¾	39.23	2,580	71.0	6.70	126.9	0.00505
2	....	.....do.............	Same as for red fir No. 4.	3	30	12.3	225	3,085	338.0	370	2.980	113.2	200.0	34.62	8¼	37.34	2,980	86.0	6.51	176.0	.00890
3	Boiled....	Straight, cut 8 to to inch.	Same as poplar No. 5.	2	40	16.4	225	3,080	198.0	238	2.580	76.7	226.0	32.18	6⅝	38.60	2,286	71.1	11.57	110.0	.00392
4	...do......	.....do.............	Same surface....	2	60	24.65	225	3,080	286.0	352	4.013	71.2	322.0	32.18	6⅝	38.60	2,492	77.5	9.79	125.0	.00376
5	...do......	.....do.............	.....do..........	2	80	32.8	225	3,080	334.0	415	4.475	74.6	355.0	32.18	7⅜	38.60	2,520	78.4	12.60	130.6	.00331
6	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as for No. 21 California lodgepole.	2	40	16.4	100	1,364	138.8	150	.718	193.1	52.4	34.15	8	40.50	2,740	80.3	10.80	167.1	.00620
7	....	.....do.............	Same surface....	2	60	24.65	100	1,364	191.0	222	1.218	157.0	85.4	34.15	8	40.50	2,855	83.6	4.61	163.6	.00568
8	....	.....do.............	.....do..........	2	80	32.8	100	1,364	259.0	294	1.997	129.7	130.0	34.15	7⅝	40.50	3,075	90.0	5.22	163.9	.00580
9	....	.....do.............	.....do..........	2	100	41.0	100	1,364	287.0	322	2.550	112.6	163.3	34.15	8⅛	40.50	3,120	91.5	8.01	161.2	.00513

[1] For cooking conditions see Table 32.

TABLE 29.—*Grinder runs on aspen.*[1]

Run No.	Preliminary treatment of wood.	Stone.		Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
		Kind of burr.	Surface.																		
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*° F.*	
1	Steamed..	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed...	3	40	16.4	200	2,762	209.3	266	3.300	63.4	353.0	24.86	6½	51.95	1,870	75.2	6.13	133.3	0.00461
2	....	.....do............	Same as red fir No. 3.	3	30	12.3	225	3,085	325.0	374	2.340	139.0	210.0	26.61	5¼	43.28	2,227	83.8	6.86	175.7	.00856
3	Boiled.....	Straight, cut 8 to inch.	Stone dressed...	2	40	16.4	225	3,080	179.0	209	2.824	63.4	321.0	25.33	6½	42.88	1,756	69.4	7.41	108.5	.00354
4	...do......	.....do............	Same surface....	2	60	24.65	225	3,080	240.0	290	3.383	70.8	365.0	25.33	7⅛	42.88	1,856	73.3	9.01	124.1	.00316
5	...do......	.....do............	.....do..........	2	80	32.8	225	3,080	277.0	318	4.590	60.5	479.0	25.33	7⅛	42.88	1,920	75.9	10.87	116.0	.00274
6	....	Straight, cut 8 to inch; spiral, cut 10 to inch.	Same as No. 9 birch.	2	40	16.4	100	1,364	137.0	164	.438	313.0	40.7	24.00	5½	46.70	2,150	89.6	3.26	171.1	.00612
7	....	.....do............	Same surface....	2	60	24.65	100	1,364	198.0	220	.895	221.0	80.2	24.00	5⅞	46.70	2,230	93.0	7.21	166.2	.00589
8	....	.....do............	.....do..........	2	80	32.8	100	1,364	253.0	294	1.390	182.0	128.7	24.00	5⅜	46.70	2,160	90.0	7.45	175.1	.00565
9	....	.....do............	.....do..........	2	100	41.0	100	1,364	285.0	324	1.760	162.0	166.0	24.00	6⅝	46.70	2,115	88.1	5.00	164.0	.00510
10	....	.....do............	.....do..........	2	40	16.4	200	2,728	240.0	286	.565	426.0	55.7	24.00	6	46.70	2,027	84.5	5.69	187.3	.00336
11	....	.....do............	.....do..........	2	60	24.65	200	2,728	306.0	367	1.030	297.0	98.5	24.00	6⅛	46.70	2,090	87.1	6.92	180.3	.00455
12	....	.....do............	.....do..........	2	80	32.8	200	2,728	508.0	573	2.200	231.0	200.0	24.00	6¼	46.70	2,200	91.6	6.22	176.5	.00568
13	....	.....do............	.....do..........	2	100	41.0	200	2,728	475.0	535	2.745	173.0	246.0	24.00	7	46.70	2,222	92.6	6.18	170.1	.00424

[1] For cooking conditions see Table 32.

TABLE 30.—*Grinder runs on black gum.*[1]

Run No.	Preliminary treatment of wood.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Ft. per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*°F.*	
1	....	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 21 loblolly pine.	2	40	16.40	175	2,348	234	277	0.895	261.0	75	30.71	8	47.02	2,380	77.5	6.4	128	0.00607
2	....	.....do............	Same surface....	2	60	24.65	175	2,348	322	370	1.405	229.0	106	30.71	8½	47.02	2,640	86.0	7.8	116	.00555
3	....	.....do............	.....do.........	2	80	32.80	175	2,348	421	465	2.975	141.7	225	30.71	8	47.02	2,640	86.0	6.3	158	.00548
4	....	.....do............	.....do.........	2	60	24.65	100	1,342	220	253	1.287	171.0	100	30.71	8½	47.02	2,565	83.6	2.7	168	.00664
5	....	.....do............	.....do.........	2	60	24.65	150	2,013	287	315	1.655	173.3	128	30.71	8½	47.02	2,585	84.2	4.2	167	.00579
6	....	.....do............	.....do.........	2	60	24.65	200	2,684	376	422	2.080	181.0	159	30 71	8½	47.02	2,620	85.4	1.9	170	.00568
7	....	.....do............	.....do.........	2	60	24.65	250	3,355	422	466	2.465	171.0	193	30.71	7¾	47.02	2,555	83.1	2.6	175	.00510
8	....	.....do............	Stone dressed...	2	60	24.65	200	2,684	395	444	5.305	74.4	392	30.71	7¼	47.02	2,710	88.2	2.1	139	.00595
9	Steamed..	.....do............	Same surface...	2	60	24.65	200	2,684	323	380	4.460	72.3	359	28.70	9	47.00	2,485	86.6	5.9	139	.00488
10	.....do....	.....do............	.....do.........	2	60	24.65	200	2,684	305	378	3.660	83.4	317	28.70	7	47.00	2,310	80.5	4.4	140	.00461
11	.....do....	.....do............	.....do.........	2	40	16.40	200	2,684	241	279	2.505	96.1	218	28.70	7	47.00	2,295	84.0	2.0	141	.00547
12	.....do....	.....do............	.....do.........	2	80	32.80	200	2,684	358	469	4.440	80.7	371	28.70	8¾	47.00	2,390	83.7	6.1	144	.00406
13	....	.....do............	Same as No. 22 loblolly pine.	2	60	24.65	175	2,348	294	370	3.595	81.7	278	31.40	6½	42..07	2,580	82.2	5.3	149	.00509
[2] 14	....	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as No. 29 loblolly pine.	2	20	8.20	200	2,774	137	186	1.950	70.8	158	31.40	7	42.07	2,460	78.3	20.1	130	.00603

[1] For conditions of cooking see Table 32.

[2] No. 14 was run on a coarse grit stone.

TABLE 31.—*Runs on mixtures of woods.*[1]

Kind of wood.	Run No.	Stone.		Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horse powerper ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood, bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
		Kind of burr.	Surface.																		
					Lbs. per sq. in.	*Lbs.*		*Feet per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*° F.*	
Hemlock-spruce	46-A	Straight, cut 3 to inch.	Same surface as run 45, 109-2.	3	50	20.5	175	2,450	392.0	465	4.275	91.7	......	......	......	......	......	......	......	152.5	0.00780
Hemlock	46-B	....do	....do	3	50	20.5	175	2,450	413.0	466	4.885	84.6	......	......	......	......	......	......	......	175.5	.00823
Spruce	46-C	....do	....do	3	50	20.5	175	2,450	407.0	466	4.878	83.5	......	......	......	......	......	......	......	160.0	.00810
Hemlock-Spruce	49-A	Straight, cut 3 to inch; spiral, cut 12 to inch.	Stone dressed.	3	40	16.4	175	2,445	360.4	427	4.880	73.8	......	......	......	......	......	......	......	155.0	.00899
Hemlock	49-B	Spiral, cut 12 to inch.	Same surface	3	40	16.4	175	2,445	370.0	426	4.885	75.7	......	......	......	......	......	......	......	168.3	.00922
Jack pine-tamarack	50	Spiral, cut 8 to inch; straight, cut 10 to inch.	Same as No. 221 spruce.	2	60	24.65	225	3,069	280.0	330	3.000	93.2	151 136	24.44 29.74	6 7/8 6 1/8	36.57 30.96	2,088	75.0	11.69	127.0	.00370
Do	51	Straight, cut 10 to inch.	Same as No. 50.	3	60	24.65	225	3,069	423.0	489	3.970	106.5	282 127	24.44 29.74	6 7/8 6 1/8	36.57 30.96	1,940	74.4	9.87	139.0	.00559
Do	52	....do	Same as No. 51.	3	60	24.65	225	3,069	400.0	469	3.940	101.4	132 234	24.44 29.74	6 7/8 6 1/8	36.57 30.96	2,150	77.3	11.78	142.8	.00529
Western yellow pine-Montana lodgepole pine.	20	Straight, cut 3 to inch; spiral, cut 12 to inch.	Same as No. 19; western yellow pine.	3	40	16.4	200	2,728	384.0	423	3,940	97.5	171 179	25.03 24.37	7 3/8	26.25 24.76	2,247	91.1	6.06	136.3	.00858
Do	21	Spiral, cut 12 to inch.	Same surface	3	40	16.4	200	2,728	382.0	444	3.800	100.5	110 232	25.03 24.37	7 1/2	26.25 24.76	2,220	90.6	8.09	146.2	.00852
Do	22	....do	....do	3	40	16.4	200	2,728	368.0	416	3.535	104.0	208 109	25.03 24.37	8	26.25 24.76	2,230	89.6	8.68	146.9	.00822
Montana lodgepole pine-western larch.	23	....do	....do	3	40	16.4	200	2,728	355.0	413	3.307	107.2	109 114 78	25.03 24.37 27.40	8 1/2	26.25 24.76 41.50	2,200	86.4	3.86	149.4	.00793

[1] Wood received no further treatment after barking prior to grinding on a medium-grit Lombard stone.

TABLE 31.—*Runs on mixtures of woods*—Continued.

Kind of wood.	Run No.	Stone. Kind of burr.	Stone. Surface.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood, bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Feet per minute.*			*Tons.*		*Cu. ft.*	*Lbs.*	*Inches.*	*P. ct.*	*Lbs.*	*P. ct.*	*Lbs.*	*° F.*	
Western yellow pine-Western larch.	24	Spiral, cut 12 to inch.	Same surface	3	40	16.4	200	2,728	389.0	415	3,280	118.7	173 126	25.03 27.40	9	26.25 41.50	2,198	84.4	6.14	159.1	0.00869
Do	25	do	do	3	40	16.4	200	2,728	360.0	401	3.115	115.7	210 77	25.03 27.40	9	26.25 41.50	2,170	84.2	6.14	154.8	.00803
Western larch-western hemlock.	26	do	do	3	40	16.4	200	2,728	373.0	415	3.275	114.0	104 75 109	25.03 27.40 24.62	Split	26.25 41.50 23.84	2,268	88.9	9.73	156.7	.00833
Western, hemlock-Sitka spruce	15	do	do	3	40	16.4	200	2,728	323.0	352	2.353	137.2	103 110	24.62 23.34	Split	23.84 22.26	2,212	92.1	8.26	154.0	.00721
Do	16	do	do	3	40	16.4	200	2,728	312.0	392	2.163	144.0	65 141	24.62 23.34	do	23.84 22.26	2,100	88.5	9.82	159.2	.00696
Do	17	do	do	3	40	16.4	200	2,728	347.0	392	2.348	148.0	139 75	24.62 23.34	do	23.84 22.26	2,190	90.5	9.23	163.0	.00774
Montana lodgepole pine-western larch.	24	do	do	3	40	16.4	200	2,728	377.0	405	3.235	116.5	176 121	24.37 27.40	7½	24.76 41.50	2,180	84.7	5.99	151.2	.00841
Do	25	do	do	3	40	16.4	200	2,728	403.0	458	3.300	122.1	229 80	24.37 27.40	7⅜	24.76 41.50	2,138	85.1	2.96	154.8	.00900
California lodgepole pine-red fir.	22	do	do	3	40	16.4	200	2,728	366.0	410	2.095	175.0	113 105	21.65 22.14	Split	23.88 27.65	1,917	87.5	8.82	170.2	.00817
Do	23	do	do	3	40	16.4	200	2,728	391.0	437	2.650	147.6	92 171	21.65 22.14	do	23.88 27.65	2,016	91.6	7.29	157.3	.00874
Do	24	do	do	3	40	16.4	200	2,728	376.0	431	2.137	176.0	157 73	21.65 22.14	do	23.88 27.65	1,860	85.2	7.94	170.1	.00840
California lodgepole pine-Sitka spruce.	25	do	do	3	40	16.4	200	2,728	377.0	444	2.270	166.0	117 111	21.65 23.34	do	23.88 22.26	1,988	88.4	24.90	162.7	.00842
Balsam-spruce	23	Spiral, cut 8 to inch; straight, cut 10 to inch.	Stone dressed	3	40	16.4	225	3,069	476.0	542	4.980	95.6	254 209	20.30 24.93	5¼ 5	61.66 33.55	2,160	96.2	11.50	157.0	.00945
Spruce-hemlock	63	do	do	3	50	20.5	225	3,069	516.0	592	4.075	127.0	179 179	24.93 24.47	5⅛ 5¼	33.55 44.50	2,280	92.1	12.00	177.0	.00820
Tamarack-spruce	54	do	do	2	65	26.6	225	3,069	415.0	503	4.705	88.2	185 205	30.70 23.74	5⅝ 4⅜	25.00 35.13	2,410	89.4	13.75	157.0	.00509

NOTE.—Wood for runs 50-52, inclusive, was steamed for 5 hours at 75 pounds.

TABLE 32.—*Conditions of cooking wood prior to grinding.*

Kind of wood.	Run No.	Duration of treatment.	Pressure of treatment.
		Hours.	*Pounds.*
Balsam fir	7	8	60
	15	5	75
	16	5	75
	17	5	75
	25	5	75
	26	5	75
	27	5	75
	28	5	75
	29	5	75
Red fir	2	8	60
White fir	21	6	60
	22	6	60
	23	6	60
	24	6	60
	25	6	40
	26	6	20
Amabilis fir	9	6	60
	10	6	60
	11	6	60
	12	6	60
	13	6	40
	14	6	20
Alpine fir	9	6	60
	10	6	60
	11	6	60
	12	6	60
Lowland fir	1	6	60
	2	6	60
	3	6	60
Noble fir	9	6	60
	10	6	60
	11	6	60
	12	6	30
Tamarack	12	4	40
	13	2	20
	15	2	40
	16	2	60
	17	4	20
	18	4	40

Kind of wood.	Run No.	Duration of treatment.	Pressure of treatment.
		Hours.	*Pounds.*
Tamarack	19	4	60
	20	8	20
	21	8	40
	22	8	60
	23	8	60
	25	8	60
	27	8	60
	28	8	60
	29	8	60
	30	8	60
	31	8	60
	32	5	75
	33	5	75
	34	5	75
	35	5	75
	36	5	75
	37	5	75
	38	5	[1] 75
	39	5	75
	40	5	75
	41	5	75
	42	5	75
	43	5	75
	44	5	75
	45	5	75
	46	5	75
	47	12	5
	48	5	75
	49	5	75
	55	5	75
	56	5	75
	57	5	75
	58	5	75
	59	5	75
	60	5	75
	61	5	75
	62	5	75
	63	5	75
	64	5	75
	65	5	75
	66	5	75
	67	5	75
	68	5	75
	69	12	75
	70	10	75
	71	8	75

Kind of wood.	Run No.	Duration of treatment.	Pressure of treatment.
		Hours.	*Pounds.*
Tamarack	72	6	75
	73	4	75
	74	3	75
	75	2	75
	76	1	75
Western larch	1	8	60
Montana lodgepole pine	8	8	60
	13	5	75
	14	5	75
	15	5	75
California lodgepole pine	1	8	60
Western yellow pine	1	6	40
	2	4	60
	3	8	60
	8	5	75
	9	5	75
	10	5	75
	11	12	5
White pine	9	6	60
	10	6	60
	11	6	60
	12	6	60
Jack pine	25	2	40
	26	8	60
	28	5	75
	29	5	75
	30	5	75
	31	5	75
	32	12	5
	33	5	75
Eastern hemlock	53	5	40
	54	2	60
	55	8	60
	60	5	75
	61	5	75
	62	5	75

Kind of wood.	Run No.	Duration of treatment.	Pressure of treat-
		Hours.	*Pounds.*
Englemann spruce (Colorado)	13	6	60
	14	6	60
	15	6	60
	16	6	60
	17	6	40
	18	6	20
Englemann spruce (Montana)	8	6	60
	9	6	60
	10	6	60
Sitka spruce	5	5	75
	6	5	75
	7	5	75
	16	12	5
	17	5	75
Poplar	1	8	60
	3	5	75
	4	5	75
	5	5	75
White birch	1	8	60
	3	5	75
	4	5	75
	5	5	75
Black gum	9	6	30
	10	6	60
	11	6	60
	12	6	60
Western hemlock	9	5	75
Loblolly pine	16	6	60
	17	6	60
	18	6	60
	19	6	60
	20	6	30

[1] For the wood used in grinder run No. 38, tamarack, the temperature of treatment was only 255° F.

TABLE 33.—*Quality tests—balsam.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test. Total.	Mullen test. Per 0.001 in. thickness.	Mullen test. Per pound.	Mullen test. Horsepower per ton divided by strength factor.	Schopper tests. Breaking length. Crosswise.	Schopper tests. Breaking length. Lengthwise.	Schopper tests. Breaking length. Average.	Schopper tests. Stretch. Crosswise.	Schopper tests. Stretch. Lengthwise.	Schopper tests. Stretch. Average.	Schopper tests. Breaking weight per sq. mm. sectional area.	Schopper tests. Breaking length per horsepower per ton.	Tintometer indications. Red.	Tintometer indications. Green.	Tintometer indications. Blue.	Tintometer indications. Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	104	80	36	0.0039	17.95	4.60	0.498	282	3,685	5,530	4,608	2.16	1.24	1.70	2,295	32.8	82	72	64	82
2	103	80	33	.0039	13.25	3.40	.401	250	3,030	4,910	3,970	1.84	1.12	1.48	1,835	39.6	81	71	64	84
3	111	80	31	.0041	10.40	2.54	.336	246	2,285	3,297	2,791	2.18	1.16	1.67	1,220	33.8	87	76	67	70
5	115	80	31	.00319	14.95	4.69	.482	369	3,140	4,670	3,905	2.86	1.50	2.18	2,265	22.0	80	72	65	83
6	116	80	33	.00348	14.70	4.22	.445	273	2,908	4,470	3,689	3.16	1.52	2.34	1,970	30.4	82	72	64	82
7	242	80	30	.0033	14.6	4.4	.48	258	3,000	5,280	4,140	1.98	1.20	1.59	2,010	33.4	51	36	30	183
8	224	80	34	.0036	17.2	4.8	.51	366	3,280	6,130	4,700	1.96	1.28	1.62	2,370	25.1	73	64	57	106
9	241	80	32	.0035	13.6	3.8	.43	309	3,040	4,970	4,000	1.84	1.22	1.53	1,890	30.1	72	63	58	107
10	240	80	29	.0035	12.4	3.5	.42	257	2,870	5,080	3,980	1.76	1.28	1.52	1,780	36.9	75	66	60	99
11	225	80	31	.0034	14.4	4.2	.46	529	3,260	5,710	4,480	1.86	1.20	1.53	2,180	18.4	75	66	60	99
12	238	80	32	.0035	14.8	4.2	.46	360	3,000	5,200	4,100	1.92	1.20	1.56	1,940	24.8	73	64	57	106
13	239	80	31	.0036	12.4	3.4	.40	276	2,940	4,930	3,940	1.88	1.26	1.57	1,780	35.8	76	67	61	96
14	218	80	30	.0037	14.6	4.0	.47	329	3,050	5,460	4,260	1.92	1.28	1.60	2,000	27.5	70	61	55	114
15	270	100	45	.0036	27.0	7.4	.60	346	3,860	6,200	5,030	2.12	1.28	1.70	3,450	24.2	35	22	16	227
16	277	100	48	.0040	31.0	7.7	.65	267	3,340	6,630	4,980	1.80	1.36	1.58	3,120	28.7	42	26	21	211
17	302	100	46	.0039	28.4	7.3	.62	270	3,160	5,790	4,470	1.72	1.38	1.55	3,010	26.6	38	22	16	224
18	338	80	32	.0036	14.8	4.1	.46	267	2,960	5,040	4,000	2.28	1.34	1.81	1,940	32.6	71	58	49	122
19	339	80	34	.0038	15.5	4.1	.46	262	2,910	5,120	4,010	2.34	1.48	1.91	1,840	33.3	81	71	59	89
20	329	80	32	.0038	14.5	3.9	.45	285	3,090	5,220	4,160	2.84	1.62	2.23	1,950	32.5	75	61	50	114
21	340	79	32	.0038	14.6	3.8	.46	277	3,090	5,290	4,190	2.12	1.36	1.74	1,880	32.8	80	66	56	98
22	[1]6	75	30	.0028	6.8	2.4	.22	410	1,680	3,140	2,410	.96	.70	.83	1,520	26.7	70	65	65	100
22	449	80	34	.0043	13.2	3.1	.39	232	2,640	4,650	3,640	2.16	1.18	1.67	1,580	40.3	80	69	60	91
24	741	80	34	.0042	10.8	2.6	.32	322	2,080	4,630	3,360	1.12	.88	1.00	1,420	32.6	79	69	64	88
25	484	100	33	.0028	23.1	8.3	.70	206	3,190	6,920	5,060	2.96	1.32	2.14	3,440	35.2	49	38	31	182
26	485	100	31	.0027	17.8	6.6	.57	187	3,210	6,840	5,020	2.70	1.26	1.98	3,330	47.1	48	36	31	185
27	486	100	32	.0027	20.6	7.5	.64	156	3,360	6,820	5,090	2.16	1.22	1.69	3,390	50.9	50	37	32	181
28	481	100	33	.0029	20.2	7.0	.61	162	3,400	6,040	4,720	3.22	1.06	2.14	3,170	47.8	52	38	32	178
29	487	100	34	.0029	21.2	7.2	.62	165	3,170	6,190	4,680	2.86	1.40	2.13	3,120	45.9	52	39	32	177

[1] Commercial.

TABLE 34.—*Quality tests—red fir.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test: Total.	Mullen test: Per 0.001 in. thickness.	Mullen test: Per pound.	Mullen test: Horsepower per ton divided by strength factor.	Schopper tests. Breaking length. Crosswise.	Schopper tests. Breaking length. Lengthwise.	Schopper tests. Breaking length. Average.	Schopper tests. Stretch. Crosswise.	Schopper tests. Stretch. Lengthwise.	Schopper tests. Stretch. Average.	Schopper tests. Breaking weight per sq. mm. sectional area.	Schopper tests. Breaking length per horsepower per ton.	Tintometer indications. Red.	Tintometer indications. Green.	Tintometer indications. Blue.	Tintometer indications. Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	65	80	30	0.0040	8.3	2.08	0.276	236	2,156	3,580	2,868	1.14	0.88	1.01	1,168	44.0	83	68	60	89
2	235	80	36	.0035	18.7	5.4	.52	242	2,800	5,480	4,140	1.74	1.48	1.61	2,220	33.0	44	30	23	203
4	212	80	29	.0034	10.4	3.1	.56	323	3,110	5,950	4,530	1.36	1.10	1.23	2,030	25.0	72	59	52	117
6	395	82	32	.0037	17.6	4.8	.55	382	3,290	5,930	4,610	1.94	1.08	1.51	2,180	22.0	64	52	47	137
7	398	80	32	.0037	14.5	3.9	.45	749	3,170	5,560	4,370	1.48	.88	1.18	2,060	13.0	64	49	42	145
8	396	80	36	.0040	18.0	4.5	.50	616	3,080	5,740	4,410	1.80	1.06	1.43	2,220	14.3	62	50	45	143
9	391	80	34	.0041	12.8	3.1	.38	680	2,450	4,790	3,620	1.78	1.28	1.53	1,640	14.0	60	48	42	150
10	390	80	40	.0042	18.8	4.4	.47	664	3,190	5,740	4,460	2.20	1.28	1.74	2,240	14.3	66	54	47	133
11	392	79	41	.0046	16.4	3.6	.40	527	2,880	5,530	4,200	1.44	1.08	1.26	2,080	19.9	70	55	48	127
12	393	80	36	.0040	15.4	3.8	.43	504	2,790	5,180	3,980	1.48	1.02	1.25	1,880	18.4	70	56	50	124
13	400	80	35	.0040	14.6	3.6	.42	436	3,080	5,480	4,280	1.52	1.04	1.28	2,000	23.3	65	51	45	139
14	394	80	31	.0039	11.0	2.8	.35	415	2,600	4,440	3,520	1.16	.90	1.03	1,530	24.3	71	58	51	120
15	326	80	33	.0038	14.6	3.9	.45	326	2,800	4,370	3,590	2.54	1.40	1.97	1,760	24.5	61	53	49	137
16	401	80	28	.0034	12.0	3.5	.43	292	2,710	5,300	4,000	1.40	1.04	1.22	1,740	32.0	65	54	50	131
17	397	80	32	.0040	13.2	3.3	.41	247	3,050	5,020	4,040	1.70	1.04	1.37	1,740	39.9	72	59	51	118
18	399	80	31	.0039	9.9	2.5	.32	265	2,700	4,440	3,570	1.14	.84	.99	1,480	42.1	71	57	57	115
19	cml. 8	75	34	.0034	9.9	2.9	.29	292	1,850	3,550	2,700	1.52	.96	1.24	1,660	31.9	58	54	53	135
	451	80	33	.0043	10.8	2.5	.33	256	2,650	4,150	3,400	2.00	1.08	1.54	1,450	40.1	70	55	51	124

TABLE 35.—*Quality tests—white fir.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test: Total.	Mullen test: Per 0.001 in. thickness.	Mullen test: Per pound.	Mullen test: Horsepower per ton divided by strength factor.	Schopper tests: Breaking length: Crosswise.	Schopper tests: Breaking length: Lengthwise.	Schopper tests: Breaking length: Average.	Schopper tests: Stretch: Crosswise.	Schopper tests: Stretch: Lengthwise.	Schopper tests: Stretch: Average.	Schopper tests: Breaking weight per sq. mm. sectional area.	Schopper tests: Breaking length per horsepower per ton.	Tintometer indications: Red.	Tintometer indications: Green.	Tintometer indications: Blue.	Tintometer indications: Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	459	80	36	0.0050	10.0	2.0	0.28	472	2,080	3,440	2,760	1.74	0.90	1.32	1,150	20.9	70	63	58	109
2	460	80	37	.0047	8.8	1.9	.24	448	2,070	3,390	2,730	1.62	1.04	1.33	1,260	25.4	72	65	59	104
3	461	80	33	.0043	8.0	1.9	.24	369	2,020	3,310	2,660	1.46	.90	1.18	1,230	30.0	73	66	59	102
4	462	80	32	.0040	6.9	1.7	.22	394	1,980	3,190	2,580	1.28	.88	1.08	1,200	29.7	75	66	59	100
5	463	80	37	.0045	9.4	2.1	.25	363	2,200	3,580	2,890	1.64	.98	1.31	1,340	31.9	70	63	55	112
6	464	80	36	.0045	7.4	1.6	.21	407	1,900	3,100	2,500	1.10	.86	.98	1,140	29.2	70	63	55	112
7	465	80	34	.0042	7.4	1.8	.22	380	1,840	2,980	2,410	1.16	.86	1.01	1,140	28.8	73	65	57	105
[1] 8	519	80	31	.0038	9.7	2.6	.31	374	2,160	4,350	3,260	1.46	1.00	1.23	1,590	28.2	71	63	57	109
[1] 9	520	80	36	.0043	8.4	2.0	.24	421	1,640	3,090	2,360	1.68	1.08	1.38	1,110	23.4	74	63	56	107
[1] 10	505	80	38	.0044	11.7	2.6	.31	300	2,000	3,790	2,900	1.44	.82	1.13	1,400	31.2	76	65	58	101
[1] 11	506	80	38	.0046	8.8	1.9	.23	370	1,500	2,890	2,200	1.90	1.24	1.57	1,070	25.8	72	64	57	107
[2] 12	507	80	42	.0042	16.5	3.9	.39	280	2,380	4,480	3,430	2.34	1.44	1.89	1,990	31.4	81	71	63	85
[2] 13	508	80	42	.0043	15.2	3.5	.36	300	2,000	4,290	3,140	2.44	1.56	2.00	1,780	29.0	79	70	62	89
[2] 14	509	80	42	.0048	12.4	2.6	.30	290	1,960	3,460	2,710	2.00	1.10	1.55	1,380	31.1	80	72	64	84
[2] 15	510	80	43	.0048	12.6	2.6	.29	291	1,850	3,550	2,700	2.04	1.20	1.62	1,380	32.0	79	70	62	89
17	511	80	46	.0050	12.2	2.4	.27	397	1,880	3,440	2,660	1.54	1.18	1.36	1,460	24.8	72	64	57	107
18	512	80	41	.0046	11.8	2.5	.29	345	1,990	3,610	2,800	1.76	1.10	1.43	1,470	28.0	74	64	59	103
19	513	80	46	.0054	11.9	2.2	.26	328	1,730	3,240	2,480	1.46	1.06	1.26	1,220	29.1	76	67	60	97
20	514	80	30	.0038	6.2	1.7	.21	358	1,650	2,860	2,260	1.16	.82	.99	1,040	30.0	76	65	59	100
21	527	100	50	.0042	25.2	6.0	.50	240	2,640	5,680	4,160	2.04	1.22	1.62	2,910	34.7	46	33	28	193
22	496	100	38	.0033	18.0	5.4	.47	242	2,380	5,200	3,790	1.56	1.04	1.30	2,490	33.2	49	36	30	185
23	495	100	35	.0032	10.7	3.3	.31	318	1,830	3,250	2,540	1.22	.80	1.01	1,610	25.8	49	36	30	185
24	526	100	49	.0042	17.4	4.1	.36	270	2,240	4,870	3,560	1.92	1.04	1.48	2,330	36.7	50	35	29	186
25	536	100	52	.0052	18.1	3.5	.35	273	2,160	3,860	3,010	2.38	1.06	1.72	1,830	31.5	58	43	35	164
26	537	100	46	.0053	10.0	1.9	.22	405	1,480	2,640	2,060	1.14	.72	.93	1,040	23.1	65	63	47	135
[2] 27	591	80	36	.0040	14.2	3.6	.40	282	2,640	5,300	3,970	1.82	1.12	1.47	2,040	35.1	71	63	59	107
[2] 28	594	80	37	.0042	14.7	3.5	.40	268	2,670	5,250	3,960	1.78	1.20	1.49	2,040	36.9	73	63	57	107
[2] 29	592	80	41	.0042	17.2	4.1	.42	231	3,040	5,620	4,330	1.80	1.12	1.46	2,400	44.6	67	60	55	118
[2] 30	587	80	38	.0041	12.8	3.1	.34	278	2,480	4,420	3,450	2.36	1.12	1.74	1,810	36.5	77	68	59	96
[1] 31	593	80	34	.0042	10.2	2.4	.30	373	2,180	4,030	3,100	1.66	1.04	1.35	1,560	27.7	70	58	54	118
[1] 32	589	80	34	.0044	10.0	2.2	.29	420	2,080	3,680	2,880	1.52	1.18	1.35	1,406	23.6	71	61	53	115
[1] 33	588	80	34	.0038	10.6	2.8	.31	368	2,230	4,080	3,160	2.40	1.04	1.72	1,580	27.7	70	62	53	115
[1] 34	590	80	34	.0048	13.8	2.9	.34	338	2,520	4,210	3,360	1.62	1.12	1.37	1,760	29.2	69	58	53	120
35	cml. 15	80	34	.0033	7.2	2.2	.21	383	1,420	2,840	2,130	1.18	.80	.99	1,370	26.5	62	57	55	126
35	649	80	33	.0041	8.2	2.0	.25	322	2,070	3,510	2,790	1.32	.78	1.05	1,220	34.7	75	66	58	101

[1] Wood from tree 18 inches in diameter.

[2] Wood from tree 42 inches in diameter.

TABLE 36.—*Quality tests—Alpine fir.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length. Crosswise.	Breaking length. Lengthwise.	Breaking length. Average.	Stretch. Crosswise.	Stretch. Lengthwise.	Stretch. Average.	Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	Pounds.	Inch.	Points.	Points.	Point.		Meters.	Meters.	Meters.	Per ct.	Per ct.	Per ct.	Grams.	Meters.	Parts.	Parts.	Parts.	Parts.
1	580	80	22	0.0026	7.1	2.7	0.32	368	2,070	3,790	2,930	2.70	1.12	1.95	1,430	24.9	81	73	65	81
2	581	80	36	.0040	11.6	2.9	.32	290	2,090	3,700	2,900	2.94	1.48	2.21	1,500	31.2	83	75	66	76
3	579	80	30	.0035	9.0	2.5	.30	262	1,980	1,780	1,880	2.30	1.32	1.81	1,490	23.9	83	74	67	76
4	578	80	35	.0042	9.0	2.1	.26	292	1,850	2,960	2,400	2.42	1.22	1.82	1,180	31.6	82	74	68	76
5	582	80	32	.0035	12.0	3.4	.38	262	2,240	4,180	3,210	3.12	1.38	2.25	1,660	32.2	83	75	67	75
6	577	78	35	.0038	13.0	3.4	.37	264	2,090	4,150	3,120	3.34	1.46	2.40	1,600	32.0	83	75	68	74
7	576	80	37	.0044	12.8	2.9	.35	265	2,650	4,600	3,620	1.94	1.02	1.48	1,850	39.1	81	74	67	78
8	575	80	34	.0041	11.6	2.8	.34	252	2,840	4,850	3,840	1.80	1.06	1.43	1,960	44.8	82	75	68	75
9	557	100	43	.0039	28.2	7.3	.66	188	3,200	6,970	5,080	3.04	1.40	2.20	3,230	41.0	54	42	36	168
10	558	100	37	.0035	22.5	6.5	.61	155	1,990	5,660	3,820	1.60	1.20	1.40	2,320	40.3	55	42	35	168
11	559	100	45	.0044	25.4	5.8	.56	159	2,080	5,200	3,640	1.68	1.04	1.36	2,210	40.9	56	41	35	168
12	560	100	41	.0038	25.2	5.7	.62	142	2,180	6,300	4,240	1.40	1.26	1.33	2,630	48.0	53	39	32	176
13	[1] 14	80	33	.0029	9.2	3.1	.28	300	1,670	3,020	2,340	1.16	1.68	.92	1,680	27.8	68	61	63	108
13	640	80	35	.0043	12.3	2.9	.35	240	2,830	5,120	3,980	1.70	1.06	1.38	1,720	47.4	76	70	67	87

[1] Commercial.

TABLE 37.—*Quality tests—Amabilis fir.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length. Crosswise.	Breaking length. Lengthwise.	Breaking length. Average.	Stretch. Crosswise.	Stretch. Lengthwise.	Stretch. Average.	Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	Pounds.	Inch.	Points.	Points.	Point.		Meters.	Meters.	Meters.	Per ct.	Per ct.	Per ct.	Grams.	Meters.	Parts.	Parts.	Parts.	Parts.
1	595	80	36	0.0040	16.3	4.1	0.45	205	2,560	4,900	3,730	1.92	1.06	1.49	2,170	40.3	71	62	58	109
2	596	80	41	.0045	16.8	3.7	.41	197	2,750	4,830	3,790	2.24	1.04	1.64	2,060	47.0	71	63	58	108
3	621	80	37	.0042	14.0	3.4	.38	186	2,520	4,520	3,520	2.26	1.18	1.72	1,790	49.9	76	66	60	98
4	620	80	36	.0042	12.5	3.0	.35	189	2,510	4,240	3,380	1.82	1.14	1.48	1,680	51.0	74	64	59	103
5	583	80	31	.0034	10.8	3.2	.34	265	1,980	3,950	2,960	2.74	1.42	2.08	1,630	32.9	72	64	59	105
6	585	80	37	.0039	16.8	4.4	.45	208	3,010	5,480	4,240	3.12	1.28	2.20	2,310	45.3	77	67	61	95
7	586	80	35	.0038	14.6	3.8	.42	217	2,540	4,840	3,690	2.26	1.24	1.75	2,030	40.5	75	65	59	101
8	584	79	31	.0034	11.7	3.4	.38	206	2,490	4,420	3,460	1.96	1.08	1.52	1,770	44.2	77	69	62	92
9	682	100	45	.0038	25.0	6.6	.56	230	3,830	6,160	5,000	2.34	.92	1.63	3,390	38.8	44	32	29	195
10	551	100	44	.0036	28.5	8.0	.65	152	2,900	6,120	4,510	2.62	1.14	1.88	3,180	45.5	51	37	32	180
11	552	100	37	.0030	24.1	8.1	.65	160	3,720	5,700	4,710	3.34	.98	2.16	3,360	45.3	47	36	31	186
12	549	100	36	.0030	20.6	6.8	.57	172	3,260	5,210	4,250	3.14	1.00	2.07	2,860	43.3	51	38	32	179
13	553	100	34	.0029	19.0	6.6	.56	198	2,820	5,620	4,220	1.74	.98	1.36	2,920	38.0	54	42	36	168
14	550	100	40	.0038	24.2	6.4	.60	166	3,110	5,740	4,420	3.08	1.44	2.26	2,720	44.3	65	55	47	133
15	[1] 17	80	36	.0033	10.2	3.1	.28	290	1,870	3,700	2,780	1.28	.74	1.01	1,860	34.3	68	61	60	111
15	653	80	33	.0038	13.8	3.7	.42	193	2,770	5,130	3,950	2.74	1.38	2.06	2,070	48.7	72	63	59	106

[1] Commercial.

TABLE 38.—*Quality tests—lowland fir.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length.			Stretch.			Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
									Crosswise.	Lengthwise.	Average.	Crosswise.	Lengthwise.	Average.						
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	692	100	46	0.0042	25.3	6.0	0.55	154	3,850	6,700	5,280	1.74	1.08	1.41	3,510	62.4	50	37	32	181
2	691	100	45	.0043	25.0	5.9	.55	145	3,800	7,340	5,570	2.10	1.14	1.62	3,540	69.6	50	37	31	182
3	681	100	39	.0036	22.0	6.1	.56	147	3,300	5,790	4,540	1.84	1.02	1.43	2,920	55.3	46	34	30	190
4	717	80	38	.0045	13.5	3.0	.35	199	2,880	5,530	4,200	1.58	.96	1.27	1,900	60.4	76	66	62	96
5	716	80	36	.0046	10.4	2.3	.29	216	2,340	4,580	3,460	1.48	.80	1.14	1,470	55.3	78	67	61	94
6	713	80	35	.0044	9.2	2.1	.26	236	1,960	4,080	3,020	1.28	.88	1.08	1,360	49.2	82	72	65	81
7	723	80	38	.0045	14.0	3.1	.37	220	2,550	5,160	3,860	1.90	1.12	1.51	1,790	47.4	78	70	63	89
	712	80	36	.0044	10.6	2.4	.29	281	2,360	4,440	3,400	1.66	.92	1.29	1,620	41.7	78	68	63	91
8	729	80	30	.0037	12.0	3.2	.40	202	2,770	6,020	4,400	1.44	.96	1.20	1,960	54.5	76	67	61	96
9	724	80	38	.0046	13.0	2.8	.34	243	2,750	5,120	3,940	1.50	.92	1.21	760	47.6	78	70	62	90
10	725	80	41	.0048	15.0	3.1	.36	208	2,780	5,120	3,950	1.80	.88	1.34	1,800	52.8	80	67	61	92
11	715	80	37	.0044	13.1	3.0	.35	260	2,480	5,180	3,830	1.64	1.02	1.33	1,780	42.2	80	70	65	85
12	730	80	37	.0042	17.0	4.0	.46	170	2,950	6,130	4,540	2.04	1.14	1.59	2,140	58.0	76	68	61	95
13	708	80	39	.0044	13.0	2.9	.33	213	2,610	4,900	3,760	1.52	.92	1.22	1,780	53.5	82	73	67	78
14	720	80	37	.0042	13.2	3.1	.36	231	2,630	5,140	3,880	1.78	1.04	1.41	1,860	46.7	73	65	60	102
15	722	80	35	.0042	14.2	3.4	.41	205	2,640	5,450	4,040	1.78	1.00	1.39	1,860	48.0	77	67	62	94
16	709	80	34	.0039	12.4	3.1	.36	230	2,800	5,200	4,000	1.76	.94	1.30	1,800	48.4	83	73	68	76
17	726	80	33	.0041	12.6	3.1	.38	211	2,760	5,640	4,200	1.58	.92	1.25	1,780	52.3	81	70	62	87

TABLE 39.—*Quality tests—noble fir.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test: Total.	Mullen test: Per 0.001 in. thickness.	Mullen test: Per pound.	Mullen test: Horsepower per ton divided by strength factor.	Schopper tests: Breaking length: Crosswise.	Schopper tests: Breaking length: Lengthwise.	Schopper tests: Breaking length: Average.	Schopper tests: Stretch: Crosswise.	Schopper tests: Stretch: Lengthwise.	Schopper tests: Stretch: Average.	Schopper tests: Breaking weight per sq. mm. sectional area.	Schopper tests: Breaking length per horsepower per ton.	Tintometer indications: Red.	Tintometer indications: Green.	Tintometer indications: Blue.	Tintometer indications: Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	735	80	32	0.0036	18.8	5.3	0.59	190	2,690	6,490	4,590	3.04	1.54	2.29	2,220	41.0	72	62	58	108
2	641	80	34	.0035	15.5	4.5	.46	185	3,140	5,960	4,550	1.92	1.12	1.52	2,340	53.5	73	67	60	100
3	658	80	35	.0038	15.3	4.1	.44	181	2,890	5,560	4,220	2.42	1.40	1.91	2,220	53.0	73	64	60	103
4	639	80	37	.0040	15.6	3.9	.42	165	3,090	5,440	4,260	2.20	1.14	1.67	2,090	61.3	73	63	53	111
5	642	80	37	.0037	19.0	5.2	.51	164	3,250	6,580	4,920	2.38	1.16	1.77	2,520	59.0	72	62	59	107
6	646	80	33	.0034	17.8	5.2	.54	148	3,500	6,510	5,000	1.98	1.02	1.50	2,710	62.7	71	62	57	110
7	736	80	35	.0038	19.4	5.1	.56	155	3,120	6,530	4,820	3.10	1.46	2.28	2,380	55.5	72	63	57	108
8	643	80	36	.0038	16.9	4.4	.47	179	3,040	5,950	4,500	2.22	1.16	1.69	2,420	53.4	72	62	57	109
9	706	100	40	.0032	22.5	6.9	.56	171	3,810	6,730	5,270	1.60	.90	1.25	3,610	55.2	50	35	30	185
10	701	100	42	.0033	23.0	6.9	.55	166	4,020	6,020	5,020	2.18	1.04	1.61	3,700	55.0	50	37	31	182
11	700	100	41	.0033	28.4	8.7	.69	138	4,320	7,270	5,800	2.64	1.10	1.87	4,200	60.7	50	37	31	182
12	663	100	32	.0033	16.0	4.9	.50	202	3,120	6,600	4,860	1.62	1.02	1.32	2,820	48.1	59	49	41	151
13	654	80	35	.0038	15.1	4.0	.43	179	3,100	5,870	4,480	2.70	1.40	2.05	2,180	58.2	72	64	58	106
14	734	80	41	.0042	24.9	6.0	.61	133	3,160	7,050	5,100	3.82	1.70	2.76	2,740	62.7	71	63	57	109
15	645	80	32	.0035	13.4	3.8	.42	222	2,820	5,320	4,070	2.08	1.10	1.59	2,170	43.7	72	64	60	104
16	13[1]	80	35	.0028	12.6	4.5	.36	256	2,260	4,630	3,440	1.60	.96	1.28	2,710	37.4	63	56	55	126
16	647	80	34	.0035	16.6	4.8	.49	188	3,370	6,240	4,800	1.96	1.04	1.50	2,610	52.2	72	65	60	103
17	731	80	35	.0042	14.8	3.5	.42	144	2,930	5,920	4,420	1.70	1.08	1.39	1,960	72.8	71	62	56	111
18	737	80	33	.0038	17.9	4.7	.54	133	3,010	5,970	4,490	2.60	1.20	1.90	2,160	62.4	72	62	58	108

[1] Commercial.

TABLE 40.—*Quality tests—hemlock.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
									Breaking length.			Stretch.			Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.				
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Crosswise.	Lengthwise.	Average.	Crosswise.	Lengthwise.	Average.			Red.	Green.	Blue.	Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
53	107	80	32	0.00436	10.8	2.48	0.338	224	2,385	3,725	3,055	1.46	0.72	1.19	1,295	40.3	71	59	51	119
54	105	80	33	.0046	10.25	2.23	.311	237	2,135	3,425	2,780	1.22	.92	1.07	1,150	37.6	75	61	54	110
55	232	80	35	.0035	15.2	4.30	.44	282	2,540	4,660	3,600	2.62	1.82	2.07	1,890	29.0	45	29	23	203
56	219	80	30	.0038	9.2	2.4	.31	677	2,470	4,520	3,500	1.34	1.18	1.26	1,490	16.7	66	57	52	125
60	257	100	54	.0048	28.2	5.9	.52	380	3,070	5,870	4,470	2.48	1.50	1.99	2,820	22.6	42	27	20	211
61	255	100	54	.0049	28.3	5.8	.52	255	3,000	5,810	4,400	2.62	1.60	2.11	2,600	33.2	41	26	20	214
62	256	100	55	.0047	28.3	6.0	.51	256	2,860	5,620	4,240	3.22	1.58	2.40	2,730	32.5	41	26	19	213

NOTE.—For run No. 63 see Mixture of woods.

TABLE 41.—*Quality tests—western hemlock.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
									Breaking length.			Stretch.			Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.				
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Crosswise.	Lengthwise.	Average.	Crosswise.	Lengthwise.	Average.			Red.	Green.	Blue.	Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	215	80	31	0.0037	13.4	3.6	0.42	320	2,900	5,700	4,300	2.10	1.24	1.67	2,000	32.0	62	53	49	136
5	372	80	37	.0040	19.6	4.9	.53	245	3,290	6,260	4,780	2.58	1.48	2.03	2,220	36.8	67	55	48	130
6	373	80	36	.0041	16.5	4.0	.46	308	2,760	5,000	3,880	2.44	1.60	2.02	1,730	27.3	65	55	49	131
7	403	80	31	.0033	16.6	5.0	.54	306	3,100	5,740	4,420	2 04	1.14	1.59	2,170	26.8	66	53	48	133
8	402	80	26	.0030	11.3	3.8	.44	436	3,170	5,230	4,200	1.70	.94	1.32	1,830	21.8	61	51	45	143
9	321	100	45	.0036	28.0	7.8	.62	296	3,440	5,580	4,510	2.68	1.36	2.02	3,160	24.6	36	22	16	226
10	352	80	33	.0035	17.0	4.9	.52	505	3,570	6,350	4,960	1.98	1.24	1.61	2,340	18.9	63	50	43	144
11	341	80	32	.0044	15.9	3.6	.50	171	2,920	4,780	3,850	2.10	1.32	1.71	1,760	45.1	75	61	53	111
12	342	80	32	.0040	10.0	2.7	.34	217	2,650	4,510	3,580	1.60	1.12	1.36	1,500	48.5	70	57	50	123
13	353	79	34	.0043	10.1	2.4	.30	234	2,400	4,320	3,350	1.56	1.24	1.40	1,360	47.7	71	58	50	121
14	354	80	33	.0045	10.4	2.3	.31	201	2,450	4,100	3,280	1.54	1.12	1.33	1,290	52.5	73	60	51	116
18	[1] 2	75	33	0028	10.1	3.6	31	406	2,430	4,290	3,360	1.36	.92	1.14	2,160	26.7	56	53	53	138
18	445	80	34	.0039	17.8	4.6	.52	242	3,000	5,720	4,360	2.80	1.46	2.13	2,080	34.6	64	52	45	139

NOTE.—For runs 15-17, inclusive, see Mixture of woods.

[1] Commercial.

TABLE 42.—*Quality tests—tamarack.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length. Crosswise.	Breaking length. Lengthwise.	Breaking length. Average.	Stretch. Crosswise.	Stretch. Lengthwise.	Stretch. Average.	Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	109	80	32	0.00404	12.25	3.04	0.383	235	2,700	4,200	3,450	2.48	1.28	1.88	1,570	38.3	83	66	57	94
2	35	80	32	.0042	13.40	3.19	.419	430	2,700	4,460	3,580	1.94	1.20	1.57	1,600	19.9	69	57	48	126
3	1	80	32	.0038	8.00	2.10	.250	356	1,829	4,313	3,071	1.21	1.06	1.14	1,199	34.4	73	65	57	105
4	15	80	33	.0044	8.90	2.02	.270	287	2,140	3,705	2,922	1.24	.78	1.01	1,130	37.8	79	65	52	104
5	31	80	32	.0040	11.40	2.85	.356	388	2,460	4,635	3,548	1.88	.90	1.39	1,510	25.7	68	56	50	126
6	32	80	32	.0043	9.25	2.15	.289	288	1,920	3,760	2,840	1.18	.72	.95	1,120	34.1	73	61	51	115
7	34	80	32	.0048	8.05	1.68	.252	278	1,612	3,110	2,361	.90	.68	.79	903	33.7	74	61	55	110
9	117	80	33	.00355	11.80	3.32	.358	762	2,376	3,698	3,037	2.94	1.54	2.24	1,505	11.1	70	59	55	116
10	119	60	35	.00372	13.95	3.75	.398	791	2,672	4,365	3,519	2.08	1.52	1.80	1,823	11.2	65	60	56	119
11	9	80	33	.0051	5.3	1.04	.161	334	1,269	2,625	1,948	.83	.74	.78	736	36.2	77	58	49	126
12	114	80	33	.00426	9.4	2.203	.2845	240	1,882	2,780	2,331	1.98	.92	1.45	1,002	34.0	80	70	62	88
13	113	80	34	.00447	8.35	1.866	.2455	277	1,660	2,856	2,258	1.90	1.04	1.47	906	33.2	87	77	70	66
14	112	80	30	.00344	5.70	1.660	.190	332	1,464	2,065	1,765	1.00	.56	.78	993	28.0	65	56	52	127
15	88	80	35	.00474	10.35	2.18	.296	250	2,370	3,600	2,985	1.20	.80	1.00	1,186	40.4	77	61	54	108
16	101	80	33	.00428	11.75	2.74	.356	251	2,565	4,000	3,283	1.68	1.00	1.34	1,373	36.7	75	59	52	114
18	93	80	35	.0044	15.45	3.51	.441	236	2,950	4,740	3,845	1.64	.98	1.31	1,656	36.8	67	51	44	138
19	98	80	33	.00387	15.50	4.00	.470	208	3,110	4,800	3,955	1.98	1.04	1.51	1,820	40.5	72	58	51	119
20	94	80	31	.00498	7.95	1.595	.257	245	2,250	3,310	2,780	1.04	.76	.90	1,012	44.3	81	63	55	101
21	99	79	33	.00407	13.30	3.26	.403	202	2,924	4,450	3,687	1.98	1.06	1.52	1,683	45.2	73	61	58	108
22	89	80	33	.00364	15.75	4.33	.477	204	3,000	4,740	3,870	1.68	.90	1.29	1,780	39.8	67	52	43	138
22	90	100	30	.00357	9.95	2.79	.332	293	2,515	3,550	3,033	1.18	.62	.90	1,315	31.2	52	33	25	190
23	84	80	34	.00376	16.25	4.32	.478	175	2,990	4,975	3,983	2.04	1.00	1.52	1,975	47.6	51	36	29	184
24	100	80	36	.0050	8.5	1.70	.236	292	1,922	3,150	2,536	.92	.80	.86	1,037	36.8	83	72	64	81
25	233	80	35	.0036	16.8	4.6	.48	210	2,510	5,200	3,860	2.04	1.38	1.71	1,950	38.4	43	27	20	210
26	220	80	32	.0040	11.2	2.8	.35	455	2,520	4,700	3,610	1.76	1.26	1.51	1,600	22.6	64	54	46	136
27	282	100	44	.0045	17.5	3.90	.40	151	2,780	4,430	3,600	1.94	1.34	1.64	1,960	59.7	44	29	20	207
28	288	100	51	.0053	19.0	3.60	.37	173	2,450	3,900	3,180	2.52	1.38	1.95	1,780	49.7	43	27	19	211
29	289	100	45	.0045	17.3	3.80	.38	169	2,410	4,310	3,360	2.06	1.48	1.77	1,910	52.2	43	26	18	213
30	281	100	43	.0044	16.6	3.80	.38	194	2,640	4,680	3,660	1.80	1.38	1.59	2,000	49.5	44	28	19	209
31	286	100	46	.0050	17.6	3.60	.38	191	2,470	4,040	3,250	1.74	1.26	1.50	1,730	44.9	49	32	24	195
32	275	100	46	.0041	18.8	4.60	.41	220	2,870	4,910	3,890	2.32	1.36	1.84	2,270	43.2	40	24	16	220
33	279	100	53	.0049	22.4	4.50	.42	200	2,630	4,930	3,780	1.86	1.56	1.71	2,280	44.9	39	23	16	222
34	284	100	39	.0038	16.0	4.2	.41	214	2,960	4,950	3,960	1.66	1.32	1.49	2,264	45.0	42	26	18	214

35	386	100	38	.0038	16.7	4.4	.44	245	2,770	5,120	3,940	1.60	.94	1.27	2,220	36.6	47	38	24	191
36	383	100	50	.0051	21.0	4.1	.42	195	2,840	4,910	3,880	1.72	1.02	1.37	2,140	47.4	49	33	24	194
37	380	100	44	.0044	22.6	5.1	.51	188	2,750	5,290	4,020	3.18	1.28	2.23	2,270	42.0	42	27	19	212
38	364	80	42	.0049	17.3	3.5	.41	298	2,730	5,040	3,880	2.22	1.46	1.84	1,720	31.8	60	49	40	151
39	249	100	51	.0048	23.2	4.8	.46	278	2.880	2,690	2,780	2.28	.88	1.58	1,670	21.8	35	21	15	229
40	251	100	47	.0044	21.5	4.8	.46	201	2,680	5,030	3,860	2.32	1.36	1.84	2,200	41.7	36	23	17	224
41	254	100	53	.0050	25.8	5.2	.49	196	2,790	5,300	4,040	2.90	1.52	2.21	2,440	42.0	36	23	17	224
42	250	100	47	.0042	21.8	5.2	.46	290	2,850	4,490	3,670	1.90	1.12	1.51	2,220	27.5	36	22	16	226
43	252	100	42	.0038	19.3	5.0	.46	237	2,490	4,800	3,640	1.50	1.34	1.42	2,200	33.4	39	24	17	220
44	253	100	44	.0040	20.2	5.0	.46	224	2,610	4,850	3,730	2.02	1.32	1.67	2,190	36.2	42	26	19	213
45	272	100	55	.0049	24.0	4.9	.44	236	2,590	4,990	3,790	2.22	1.40	1.81	2,270	36.6	36	21	14	229
46	379	100	55	.0049	16.7	3.4	.30	318	2,310	4,280	3,300	1.80	1.28	1,54	2,130	34.6	39	22	14	225
47	327	80	43	.0046	17.5	3.8	.40	725	2,800	4,300	3,550	2.78	1.38	2.08	1,820	12.2	52	41	33	174
48	320	100	52	.0049	21.0	4.3	.40	198	2,680	4,040	3,360	2.34	1.34	1.84	1,990	42.3	41	25	18	216
49	348	80	35	.0047	7.8	1.7	.22	296	1,880	3,190	2,540	1.14	1.00	1.07	970	39.0	66	56	46	132
53	[1]11	75	35	.0033	7.4	2.2	.21	454	1,640	2,960	2,300	1.10	.72	.91	1,400	24.1	52	46	46	156
53	454	80	37	.0045	12.0	2.6	.32	298	2,250	3,950	3,100	1.54	.98	1.26	1,490	32.5	76	63	56	105
55	686	100	53	.0048	23.0	4.8	.43	255	3,210	5,480	4,340	2.20	1.24	1.72	2,910	39.6	42	31	27	200
56	689	100	55	.0047	25.9	5.6	.47	222	3,320	5,730	4,520	1.98	.98	1.48	3,260	43.2	45	33	27	195
57	690	100	49	.0043	23.1	5.3	.47	226	3,230	5,860	4,540	2.16	1.16	1.66	3,030	42.7	44	32	27	197
58	683	100	60	.0052	25.4	4.9	.42	268	2,750	5,160	3,960	1.94	1.24	1.59	2,840	35.2	44	32	27	197
59	687	100	48	.0044	18.8	4.3	.39	308	2,840	5,170	4,000	2.00	1.38	1.69	2,560	33.3	49	25	30	186
60	684	100	50	.0046	20.7	4.5	.41	279	2,820	5,450	4,140	1.50	1.24	1.37	2,670	36.2	43	32	28	197
61	685	100	48	.0042	23.6	5.6	.49	269	3,520	5,060	4,290	1.68	.94	1.31	2,960	32.5	46	33	28	193
62	488	100	44	.0037	14.8	4.0	.34	239	2,330	3,900	3,120	2.20	1.08	1.64	2,160	38.4	45	33	28	194
63	489	100	39	.0036	14.8	4.1	.38	207	2,130	3,720	2,920	2.98	1.36	2.17	1,860	37.1	45	33	27	196
64	490	100	36	.0032	12.7	3.9	.35	230	1,980	3,300	2,640	2.95	1.15	2.05	1,750	32.8	45	33	28	194
65	491	100	36	.0032	14.2	4.5	.40	221	2,400	3,980	3,190	1.52	.84	1.18	2,100	36.1	46	34	28	192
66	492	100	29	.0025	9.5	3 8	.33	286	2,210	3,290	2,750	.96	.63	.80	1,780	29.1	45	34	28	193
67	493	100	37	.0033	15.0	4.6	.40	257	2,420	4,560	3,490	1.73	1.10	1.42	2,260	34.0	42	30	25	203
68	494	100	38	.0032	17.4	5.4	.45	220	2,400	4,420	3,410	1.78	1.14	1.46	2,480	34.4	44	32	26	198
69	528	100	44	.0042	12.8	3.1	.29	230	1,870	3,700	2,780	2.16	1.02	1.59	1,760	41.7	36	25	20	219
70	529	100	44	.0043	12.4	2.9	.28	252	1,500	3,100	2,300	2.46	1.02	1.74	1,330	32.5	39	27.	23	211
71	530	100	43	.0038	12.2	3.2	.28	260	1,740	3,610	2,675	2.98	1.46	2.22	1,730	36.8	40	27	23	210
72	531	100	51	.0046	19.2	4.2	.38	202	1,960	4,180	3,070	3.48	1.34	2.41	1,930	40.0	42	30	25	203
73	532	100	52	.0047	21.1	4.5	.41	180	2,180	4,550	3,360	4.32	1.66	2.99	2,110	45.5	46	35	30	189
74	533	100	50	.0049	16.6	3.4	.33	225	1,890	3,570	2,730	3.32	1.44	2.38	1,650	36.8	49	37	29	185
75	534	100	53	.0055	17.6	3.2	.33	212	1,970	3,480	2,720	3.20	1.40	2.30	1,560	38.8	54	42	36	168
76	535	100	50	.0052	13.3	2.6	.27	244	1,840	3,230	2,540	2.52	1.34	1.93	1,510	38.4	59	47	41	153
77	523	100	64	.0078	12.6	1.6	.20	289	1,660	1,730	1,700	1.76	1.88	1.82	840	29.4	67	56	51	126
78	721	80	40	.00444	16.6	3.8	.42	389	2,720	5,950	4,340	1.94	.98	1.46	2,030	26.5	66	56	50	128
79	655	80	39	.0045	11.2	2.5	.29	659	2,620	4,320	3,470	1.98	1.20	1.59	1,560	18.2	62	52	46	140
80	719	82	40	.0040	18.2	4.6	.45	822	3,090	6,040	4,560	2,14	1.14	1.64	2,470	12.3	62	51	45	142
81	718	80	41	.0043	17.0	4.0	.42	888	2,900	5,500	4,200	1.78	.98	1.38	2,150	11.3	61	50	43	146

[1] Commercial.

NOTE.—For runs 50 to 52, inclusive, and run 54 see quality tests—mixtures of woods.

TABLE 43.—*Quality tests—western larch.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
									Breaking length.			Stretch.								
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Crosswise.	Lengthwise.	Average.	Crosswise.	Lengthwise.	Average.	Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	*Lbs.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	108	80	33	0.00375	14.9	3.97	0.451	260	2,380	4,620	3,500	2.26	1.28	1.77	1,750	29.8	53	38	29	180
2	221	80	34	.0048	6.6	1.4	.20	518	1,590	2,910	2,250	1.14	.98	1.06	869	21.7	56	42	36	166
5	328	80	39	.0047	10.0	2.2	.26	716	1,980	3,360	2,680	1.94	1.30	1.62	1,250	14.4	81	47	36	136
6	344	80	36	.0042	11.3	2.7	.31	900	2,380	4,310	3,350	1.56	1.26	1.41	1,520	12.0	59	45	35	161
7	739	80	33	.0046	4.4	.9	.13	665	1,160	2,030	1,600	.78	.58	.68	570	18.5	62	48	42	148
8	456	80	39	.0055	9.5	1.7	.24	500	1,770	3,050	2,410	1.40	.90	1.15	1,030	20.0	66	53	46	135
9	457	80	42	.0056	9.6	1.7	.23	420	1,750	2,720	2,240	1.62	1.02	1.32	1,000	23.2	63	52	45	140
10	458	80	40	.0056	7.0	1.3	.18	480	1,500	2,4[illegible]0	1,970	1.42	.92	1.17	830	22.8	61	53	47	136

TABLE 44.—*Quality tests—Montana lodgepole pine.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test. Total.	Mullen test. Per 0.001 in. thickness.	Mullen test. Per pound.	Mullen test. Horsepower per ton divided by strength factor.	Schopper tests. Breaking length. Crosswise.	Schopper tests. Breaking length. Lengthwise.	Schopper tests. Breaking length. Average.	Schopper tests. Stretch. Crosswise.	Schopper tests. Stretch. Lengthwise.	Schopper tests. Stretch. Average.	Schopper tests. Breaking weight per sq. mm. sectional area.	Schopper tests. Breaking length per horsepower per ton.	Tintometer indications. Red.	Tintometer indications. Green.	Tintometer indications. Blue.	Tintometer indications. Black.
		Per ct.	*Lbs.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	70	80	32	0.0038	16.15	4.25	0.505	247	3,430	5,780	4,605	2.00	1.12	1.56	2,140	37.0	84	70	61	85
2	38	80	33	.0045	14.20	3.16	.430	245	2,325	4,830	3,578	2.08	1.18	1.63	1,445	33.9	86	72	62	80
3	30	80	32	.0044	8.90	2.02	.278	250	2,025	4,100	3,063	1.16	.84	1.00	1,210	44.1	86	71	62	81
4	2	80	31	.0039	7.30	1.87	.235	272	2,018	4,452	2,985	1.34	.86	1.10	1,159	46.6	88	76	68	68
5	36	80	34	.0039	13.25	3.40	.390	277	2,465	5,110	3,788	2.14	1.22	1.68	1,810	35.1	81	70	62	87
6	46	80	33	.0039	11.90	3.05	.361	268	2,360	4,440	3,400	2.46	1.24	1.85	1,490	35.1	88	71	62	79
7	37	80	30	.0037	8.90	2.40	.296	298	1,923	4,035	2,979	2.02	1.10	1.56	1,258	33.7	85	73	66	76
8	7	80	34	.0033	17.35	5.26	.510	203	2,170	5,158	3,664	1.55	.98	1.27	1,705	35.4	55	35	27	183
9	222	80	30	.0040	11.6	2.9	.38	299	2,630	4,980	3,800	2.16	1.35	1.76	1,600	33.4	80	69	61	90
13	283	100	42	.0034	23.3	7.0	.55	257	3,520	6,950	5,240	1.80	1.36	1.58	3,730	37.1	39	22	15	224
14	378	100	46	.0038	30.5	8.0	.66	194	2,820	5,720	4,270	4.62	1.52	3.07	2,930	33.4	46	26	18	210
15	280	100	47	.0038	25.2	6.6	.54	246	3,110	5,740	4,440	1.96	1.30	1.63	3,040	33.6	40	26	17	217
16	330	80	35	.0045	13.6	3.0	.39	247	2,600	4,300	3,450	2.12	1.18	1.65	1,480	35.9	81	70	60	89
17	331	80	36	.0047	14.2	3.0	.39	262	3,000	4,580	3,790	2.02	1.18	1.60	1,580	37.1	82	71	60	87
18	346	80	49	.0045	17.1	3.8	.35	316	3,120	5,470	4,300	2.12	1.22	1.67	1,890	38.9	81	68	57	94
19	345	80	36	.0044	14.4	3.3	.40	265	2,770	4,720	3,740	2.10	1.28	1.69	1,660	35.3	82	67	56	95
20	429	80	30	.0036	12.2	3.4	.40	323	2,880	5,120	4,000	1.72	.94	1.33	1,790	31.0	73	64	55	108
21	430	80	30	.0035	13.2	3.8	.44	308	2,930	5,840	4,380	1.84	1.00	1.42	2,010	32.3	77	68	59	96
22	431	80	37	.0042	17.4	4.1	.44	231	2,980	5,420	4,200	2.10	1.02	1.56	1,980	41.3	79	70	60	91
23	432	80	31	.0040	12.0	3.0	.39	243	2,640	4,530	3,580	1.88	.90	1.39	1,550	37.8	80	67	57	96
26	[1] 4	75	33	.0028	8.9	3.2	.27	510	1,870	3,980	2,920	1.20	.76	.98	1,980	21.2	60	54	54	132
26	447	80	33	.0038	13.8	3.6	.42	328	2,840	4,940	3,890	2.34	1.48	1.91	1,820	28.2	71	57	46	126

[1] Commercial.

NOTE.—For runs 24 and 25, see Mixture of woods.

TABLE 45.—*Quality tests—lodgepole pine (California).*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length.			Stretch.			Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
									Crosswise.	Lengthwise.	Average.	Crosswise.	Lengthwise.	Average.						
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	236	80	33	0.0031	18.4	6.0	0.56	222	2,530	5,620	4,080	1.78	1.38	1.58	2,120	32.8	45	28	21	206
2	213	80	32	.0041	12.2	3.0	.38	362	2,760	5,180	3,970	1.46	.90	1.18	1,630	28.9	72	62	56	110
10	360	80	34	.0042	15.0	3.6	.44	527	2,950	6,100	4,520	1.96	1.30	1.63	1,920	19.5	78	69	61	92
11	361	80	35	.0040	17.6	4.4	.50	428	2,850	5,550	4,200	3.32	1.82	2.57	1,910	19.6	76	67	59	98
12	362	80	36	.0043	15.3	3.6	.42	593	2,490	5,140	3,820	2.36	1.60	1.98	1,690	15.3	77	65	57	101
13	371	80	36	.0043	14.2	3.3	.39	534	2,240	4,620	3,430	2.38	1.60	1.99	1,500	16.5	62	52	46	140
14	363	80	38	.0044	17.2	3.9	.45	555	2,700	5,180	3,940	2.84	1.52	2.18	1,760	15.8	83	73	64	80
15	323	80	32	.0030	11.3	3.7	.36	448	2,030	3,550	2,790	1.58	1.10	1.34	1,680	17.3	80	67	60	93
16	369	82	35	.0044	12.8	2.9	.37	362	2,580	4,710	3,640	2.28	1.48	1.88	1,540	27.2	78	68	58	96
17	387	84	31	.0038	11.8	3.1	.38	309	2,800	4,370	3,580	1.56	.78	1.17	1,520	30.5	84	74	59	83
18	376	80	34	.0044	12.0	2.7	.35	332	2,200	4,220	3,210	2.00	1.58	1.79	1,280	27.7	80	70	60	90
19	433	80	34	.0039	16.1	4.1	.47	509	2,840	5,740	4,290	1.92	1.06	1.49	2,030	17.9	80	70	60	90
20	434	80	32	.0038	13.6	3.6	.42	468	2,840	5,510	4,180	2.02	.96	1.49	1,920	21.3	74	60	55	111
21	435	80	31	.0038	12.4	3.3	.40	349	2,800	5,400	4,100	1.46	.92	1.19	1,790	29.4	70	62	53	115
26	cml. 7	75	34	.0034	7.4	2.2	.22	352	1,450	2,740	2,100	1.32	.80	1.06	1,320	27.1	62	57	57	124
26	450	80	34	.0050	9.6	1.9	.28	277	2,230	3,750	2,990	1.68	.94	1.31	1,120	38.6	75	62	55	108

NOTE.—For runs 22 to 25, inclusive, see Mixture of woods.

TABLE 46.—*Quality tests—western yellow pine.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test. Total.	Mullen test. Per 0.001 inch of thickness.	Mullen test. Per pound.	Mullen test. Horsepower per ton divided by strength factor.	Schopper tests. Breaking length. Crosswise.	Schopper tests. Breaking length. Lengthwise.	Schopper tests. Breaking length. Average.	Schopper tests. Stretch. Crosswise.	Schopper tests. Stretch. Lengthwise.	Schopper tests. Stretch. Average.	Schopper tests. Breaking weight per square millimeter sectional area.	Schopper tests. Breaking length per horsepower per ton.	Tintometer indications. Red.	Tintometer indications. Green.	Tintometer indications. Blue.	Tintometer indications. Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	102	79	35	0.00316	11.4	3.61	0.326	282	2,296	3,456	2,876	1.36	0.68	1.02	1,878	31.3	79	57	49	115
2	106	80	34	.0051	11.9	2.34	.350	218	2,240	3,770	3,005	1.16	.90	1.93	1,250	39.4	84	70	62	84
3	5	80	34	.0043	11.15	2.59	.328	226	1,778	4,583	3,181	1.01	1.05	1.03	1,375	43	81	61	53	105
4	223	80	35	.0049	11.3	2.3	.32	324	2,340	4,400	3,370	1.86	1.28	1.57	1,340	32.5	79	67	59	95
8	300	100	47	.0044	28.6	6.5	.61	247	3,560	6,000	4,780	2.46	1.58	2.02	2,990	31.8	51	34	25	190
9	271	100	33	.0031	16.2	5.23	.49	226	2,870	5,300	4,080	1.76	1.30	1.53	2,350	36.9	50	34	24	192
10	273	100	46	.0042	25.0	5.0	.54	223	3,090	5,620	4,360	1.86	1.36	2.11	2,680	36.3	48	30	22	200
11	319	100	35	.0037	15.4	4.2	.44	719	2,970	5,540	4,260	1.84	1.40	1.62	2,260	13.5	72	59	49	120
12	347	80	36	.0038	12.5	3.3	.35	293	2,950	4,830	3,890	1.94	1.22	1.58	1,630	38	80	68	59	93
13	351	80	34	.0044	13.5	3.1	.40	346	2,660	5,080	3,870	1.78	1.18	1.48	1,560	28	81	69	58	92
14	349	80	34	.0045	11.4	2.5	.33	424	2,500	4,460	3,480	1.92	1.18	1.55	1,350	24.8	81	68	57	94
15	350	80	34	.0046	12.5	2.7	.37	364	2,690	4,900	2,800	1.76	1.12	1.44	1,460	20.8	81	67	55	97
16	408	80	37	.0048	14.6	3.0	.40	286	2,890	5,380	4,140	1.60	.88	1.24	1,820	36.2	76	64	55	105
17	422	80	37	.0046	11.2	2.4	.30	271	2,420	4,060	3,240	1.56	1.04	1.30	1,400	39.9	76	64	55	105
18	409	80	32	.0046	8.0	1.7	.25	263	2,180	3,330	2,760	1.00	.66	.83	1,060	41.9	77	65	56	102
19	423	80	41	.0055	11.2	2.0	.27	233	2,070	3,680	2,880	1.40	.98	1.19	1,200	45.8	77	63	54	106
27	[1]5	75	32	.0033	5.4	1.6	.17	379	1,150	2,710	1,930	.78	.74	.76	1,040	29.9	61	56	56	127
27	448	80	36	.0048	9.4	2.0	.26	248	2,050	3,500	2,780	1.92	.92	1:42	1,150	43.1	74	62	51	113

[1] Commercial.

NOTE.—For runs 20 to 26, inclusive, see Mixture of woods.

TABLE 47.—*Quality tests—jack pine.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length. Crosswise.	Breaking length. Lengthwise.	Breaking length. Average.	Stretch. Crosswise.	Stretch. Lengthwise.	Stretch. Average.	Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
25	120	80	31	0.00445	8.4	1.89	0.271	267	2,272	3,000	2,636	1.28	0.74	1.01	963	36.4	87	72	65	76
26	231	80	34	.0036	14.6	4.0	.43	258	2,180	4,530	3,360	1.92	1.30	1.61	1,630	30.4	50	34	26	190
27	214	80	34	.0047	11.8	2.5	.35	427	2,340	4,710	3,530	2.24	1.12	1.68	1,420	23.6	76	64	57	103
28	276	100	45	.0042	22.5	5.3	.50	296	3,140	4,860	4,000	2.28	1.26	1.77	2,340	27.1	48	36	22	200
29	285	100	49	.0048	22.8	4.8	.46	265	2,900	5,480	4,190	2.08	1.56	1.82	2,140	34.3	51	33	24	192
30	287	100	43	.0044	20.3	4.6	.47	250	2,680	5,030	3,860	2.06	1.66	1.81	2,200	32.9	48	30	23	199
31	269	100	40	.0038	18.2	4.9	.46	264	2,770	4,940	3,860	2.16	1.28	1.72	2,180	31.8	46	28	20	206
32	301	100	47	.0050	21.0	4.2	.45	545	3,280	5,390	4,340	2.40	1.36	1.88	2,360	17.7	65	50	38	147
33	298	100	37	.0042	13.0	3.1	.35	251	2,180	3,580	2,880	1.70	1.48	1.59	1,140	32.8	48	31	24	197

TABLE 48.—*Quality tests—loblolly pine.*

FALL-CUT WOOD.

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length. Crosswise.	Breaking length. Lengthwise.	Breaking length. Average.	Stretch. Crosswise.	Stretch. Lengthwise.	Stretch. Average.	Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	611	80	40	0.0050	11.0	2.2	0.28	330	2,150	3,840	3,000	1.62	0.90	1.26	1,420	32.4	81	70	61	88
2	610	80	42	.0052	11.1	2.1	.26	314	2,180	3,315	2,750	1.58	.84	1.17	1,330	33.7	80	71	61	88
6	612	80	44	.0050	15.2	3.0	.35	329	2,320	4,720	3,520	1.92	1.26	1.59	1,840	30.6	63	73	65	99
7	616	80	45	.0054	16.0	3.0	.36	360	2,550	4,040	3,300	1.94	1.08	1.51	1,660	25.5	82	73	64	81
8	614	80	40	.0047	16.2	3.4	.41	474	2,620	5,310	3,960	1.92	1.06	1.49	2,020	20.4	84	72	65	79
13	603	80	42	.0052	14.3	2.8	.34	276	2,525	3,950	3,240	1.78	.96	1.37	1,610	34.5	75	65	58	102
14	742	80	40	.0049	10.6	2.2	.26	362	2,100	4,130	3,120	1.42	94	1.18	1,390	33.1	76	70	62	92
14	604	80	37	.0043	10.8	2.5	.29	325	2,320	4,090	3,200	1.46	.96	1.21	1,590	34.0	74	65	59	102
19	598	100	49	.0044	20.4	4.7	.42	278	2,780	4,890	3,830	1.64	.84	1.24	2,570	32.8	42	30	25	203
23	634	80	37	.0042	10.3	2.4	.28	396	2,170	4,040	3,100	1.84	1.06	1.45	1,470	28.0	75	68	63	94
24	632	80	33	.0042	7.3	1.7	.22	415	1,770	3,470	2,620	1.54	.86	1.20	1,120	28.7	80	70	62	88
25	631	80	38	.0049	9.9	2.0	.26	328	1,940	3,620	2,780	1.48	.92	1.20	1,240	32.6	80	71	62	87
15	605	80	37	.0050	9.2	1.8	.25	353	1,930	3,830	2,880	1.22	.94	1.08	1,340	32.6	74	68	60	98
29	636	80	38	.0050	8.2	1.6	.22	325	1,910	3,320	2,620	1.28	.82	1.05	1,000	36.6	78	69	61	92
SPRING-CUT WOOD.																				
3	609	80	40	0.0045	14.1	3.1	0.35	396	2,590	4,920	3,760	1.68	1.12	1.40	1,990	27.2	71	61	55	113
4	608	80	38	.0047	11.0	2.3	.29	425	2,270	4,300	3,285	1.54	.90	1.22	1,585	26.6	70	60	54	116
5	613	80	39	.0047	12.2	2.6	.31	350	2,360	4,220	3,290	1.66	1.04	1.35	1,610	30.3	74	64	57	105
9	615	80	41	.0046	15.2	3.3	.37	354	2,810	4,530	3,670	2.10	1.12	1.61	2,040	28.0	72	61	54	113
10	617	80	39	.0045	13.5	3.0	.35	411	2,790	4,700	3,740	1.68	.88	1.28	1,840	26.0	73	62	55	110
11	606	80	33	.0040	12.0	3.0	.36	502	2,380	5,090	3,740	1.28	.92	1.10	1,800	20.7	73	65	56	106
12	607	80	27	.0035	19.2	2.6	.34	515	2,395	4,885	3,640	1.28	.80	1.04	1,730	20.8	68	58	52	122
16	597	100	48	.0042	21.9	5.3	.46	263	3,110	5,650	4,380	1.86	1.00	1.43	3,040	36.2	39	30	25	206
17	599	100	48	.0041	23.0	5.6	.48	248	2,720	6,080	4,400	2.00	1.24	1.62	3,030	37.0	41	31	26	202
18	600	100	58	.0053	26.5	5.0	.46	230	3,000	5,610	4,310	1.80	1.14	1.47	2,840	40.7	43	31	26	200
20	601	100	42	.0040	18.8	4.7	.45	271	3,060	4,940	4,000	1.32	1.06	1.19	2,840	32.8	51	40	33	176
21	602	100	50	.0064	18.8	3.0	.38	298	2,500	4,240	3,370	1.62	1.34	1.48	1,540	29.7	62	54	47	137
22	638	80	38	.0050	8.0	1.6	.21	328	1,770	3,560	2,660	1.50	.86	1.18	960	38.7	70	61	53	116
26	618	80	42	.0054	13.2	2.4	.31	338	3,020	5,760	4,390	1.24	1.04	1.14	1,550	41.9	78	67	60	95
27	637	80	45	.0057	13.8	2.4	.30	340	2,350	4,750	3,550	1.54	1.04	1.29	1,480	34.8	72	62	54	112
28	619	80	45	.0053	15.6	2.9	.35	305	2,800	4,210	3,500	1.86	.92	1.39	1,710	32.8	73	63	58	106

NOTE.—Pulp for No. 29 was made on a coarse-grit stone.

TABLE 49.—*Quality tests—white pine.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length. Crosswise.	Breaking length. Lengthwise.	Breaking length. Average.	Stretch. Crosswise.	Stretch. Lengthwise.	Stretch. Average.	Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	497	80	37	0.0039	14.7	3.8	0.40	305	2,380	4,620	3,500	2.42	1.22	1.82	1,810	28.7	76	66	60	98
2	501	80	37	.0044	13.0	3.0	.35	288	2,070	4,090	3,080	2.38	1.14	1.76	1,560	30.5	77	67	60	96
3	502	80	36	.0043	12.6	2.9	.35	257	2,120	4,010	3,060	2.18	1.16	1.67	1,530	34.0	79	70	64	87
4	503	80	38	.0046	11.2	2.5	.30	256	1,940	3,760	2,850	2.12	1.16	1.64	1,400	37.0	79	70	64	88
5	498	80	37	.0042	17.3	4.1	.47	236	2,280	4,890	3,580	2.12	1.12	1.62	1,790	32.2	77	67	61	95
6	504	80	34	.0040	13.3	3.4	.39	266	2,070	4,620	3,340	2.24	1.16	1.70	1,660	32.2	79	71	64	86
7	499	80	37	.0043	14.2	3.3	.38	258	2,230	4,290	3,260	2.06	1.22	1.64	1,610	33.2	79	69	62	90
8	500	80	38	.0044	12.8	2.9	.34	281	1,880	3,770	2,820	2.18	1.10	1.64	1,410	29.6	78	69	63	90
9	564	100	36	.0034	18.2	5.3	.50	259	2,270	4,760	3,520	2.50	.84	1.67	2,260	27.1	57	43	36	164
10	561	100	35	.0034	17.6	5.2	.50	222	2,220	5,210	3,720	2.88	1.28	2.08	2,320	33.5	59	45	38	158
11	562	100	40	.0039	19.6	5.1	.49	221	2,310	5,260	3,780	3.76	1.58	2.67	2,320	34.8	59	43	36	162
12	563	100	36	.0035	14.8	4.2	.41	270	2,140	4,510	3,320	3.68	1.20	2.44	1,980	30.0	59	44	38	159

TABLE 50.—*Quality tests—Englemann spruce (Montana).*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test. Total.	Mullen test. Per 0.001 in. thickness.	Mullen test. Per pound.	Mullen test. Horsepower per ton divided by strength factor.	Schopper tests. Breaking length. Crosswise.	Schopper tests. Breaking length. Lengthwise.	Schopper tests. Breaking length. Average.	Schopper tests. Stretch. Crosswise.	Schopper tests. Stretch. Lengthwise.	Schopper tests. Stretch. Average.	Schopper tests. Breaking weight per sq. mm. sectional area.	Schopper tests. Breaking length per horsepower per ton.	Tintometer indications. Red.	Tintometer indications. Green.	Tintometer indications. Blue.	Tintometer indications. Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	565	80	37	0.0041	12.8	3.1	0.35	226	2,350	4,160	3,260	1.64	1.00	1.32	1,720	41.2	79	71	64	86
2	566	80	35	.0040	10.0	2.5	.29	229	2,110	3,790	2,950	1.28	.84	1.06	1,440	44.5	84	74	65	77
3	568	80	38	.0044	10.6	2.4	.28	242	2,110	4,030	3,070	1.72	1.04	1.38	1,580	45.5	82	74	65	79
4	570	80	27	.0034	7.1	2.1	.26	248	2,090	3,660	2,880	1.24	.74	.99	1,340	44.6	83	74	66	77
5	573	80	32	.0039	8.7	2.2	.27	282	2,320	3,710	3,020	1.26	.82	1.04	1,460	39.6	79	70	64	87
6	567	80	33	.0038	11.2	2.9	.34	198	2,530	4,540	3,540	2.20	1.10	1.65	1,760	52.6	82	73	66	79
7	569	80	35	.0042	9.7	2.3	.28	187	2,210	3,550	2,880	1.74	.86	1.30	1,390	55.1	84	74	67	75
8	554	100	33	.0028	21.5	7.7	.65	121	3,160	6,260	4,710	2.48	.92	1.70	3,230	59.9	49	36	32	183
9	555	100	37	.0034	22.9	6.6	.62	128	3,030	6,280	4,660	3.16	1,30	2.23	3,070	58.8	55	42	35	168
10	556	100	41	.0039	23.5	6.0	.57	125	2,770	5,730	4,250	2.62	1.04	1.83	2,560	59.7	59	47	40	154
11	571	80	36	.0044	10.8	2.5	.30	220	2,140	4,160	3,150	1.38	.92	1.15	1,570	47.8	77	69	60	94
12	572	80	33	.0038	10.0	2.6	.30	195	2,430	4,360	3,400	1.52	.86	1.19	1,760	58.1	83	75	67	75
13	574	80	36	.0043	10.9	2.5	.30	193	2,440	4,180	3,310	1.40	.92	1.16	1,680	57.1	84	75	69	72
14	667	80	29	.0033	8.9	2.7	.31	277	2,950	4,780	3,860	1.18	.78	.98	1,800	44.9	71	65	60	104
15	673	80	45	.0047	15.7	3.3	.35	210	2,890	5,150	4,020	1.94	1.02	1.48	1,170	54.7	80	72	67	81
16	675	80	41	.0046	14.5	3.1	.35	185	2,850	5,280	4,060	1.82	1.00	1.41	1,920	62.8	82	77	70	71
17	674	80	38	.0043	13.2	3.1	.35	211	2,850	5,110	3,980	2.14	.98	1.56	1,900	53.8	79	72	63	86
18	669	80	40	.0047	14.3	3.0	.36	213	2,620	5,130	3,880	1.56	.92	1.24	1,860	50.6	75	71	64	90
19	677	80	36	.0043	10.5	2.4	.29	235	2,540	4,640	3,590	1.42	.86	1.14	1,540	52.5	81	73	66	80

TABLE 51.—*Quality tests—Engelmann spruce (Colorado).*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length. Crosswise.	Breaking length. Lengthwise.	Breaking length. Average.	Stretch. Crosswise.	Stretch. Lengthwise.	Stretch. Average.	Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	466	80	35	0.0039	15.6	4.0	0.45	246	2,880	5,390	4,140	2.00	1.18	1.59	2,190	37.4	75	67	62	96
2	467	80	30	.0034	10.2	3.0	.34	267	2,560	4,360	3,460	2.12	1.14	1.63	1,830	38.2	79	73	67	81
3	468	80	35	.0040	11.8	3.0	.34	251	2,580	4,680	3,630	1.78	1.08	1.43	1,910	42.5	79	73	67	81
4	740	80	37	.0044	10.7	2.5	.29	346	2,150	4,630	3,390	1.36	.92	1.14	1,560	33.9	72	65	60	103
5	469	80	31	.0040	9.0	2.3	.29	266	2,460	4,050	3,260	1.64	1.02	1.33	1,540	42.1	81	72	66	81
6	470	80	32	.0038	10.2	2.7	.32	252	2,460	4,450	3,460	1.58	1.06	1.32	1,710	42.8	81	74	67	78
7	471	80	31	.0036	9.2	2.6	.30	260	2,500	4,070	3,280	1.64	1.04	1.34	1,610	42.0	81	73	67	79
8	472	80	32	.0038	10.6	2.8	.33	230	2,510	4,200	3,360	1.96	1.08	1.52	1,660	44.1	79	72	65	84
9	515	80	36	.0042	13.2	3.1	.27	335	2,290	4,890	3,590	1.86	1.10	1.48	1,870	39.7	79	70	64	87
10	516	80	35	.0040	11.4	2.9	.33	226	2,140	4,230	3,180	1.66	1.02	1.34	1,630	42.6	82	73	65	80
11	517	80	35	.0043	12.1	2.8	.35	204	2,380	4,330	3,360	1.56	.92	1.24	1,580	47.0	82	75	68	75
12	518	80	36	.0045	10.7	2.4	.30	223	2,170	3,920	3,040	1.78	.82	1.30	1,440	45.4	84	77	69	70
13	538	100	48	.0040	34.4	8.7	.72	154	2,720	6,150	4,440	3.38	1.22	2.30	3,200	40.0	55	41	35	169
14	539	100	40	.0033	26.2	8.0	.66	147	2,750	5,540	4,140	3.56	1.06	2.31	3,020	42.5	52	39	31	178
15	540	100	37	.0031	22.6	7.2	.61	155	2,510	6,030	4,270	2.64	1.12	1.88	3,050	45.0	52	38	30	180
16	541	100	41	.0039	23.3	6.0	.57	160	2,310	5,930	4,120	2.14	.96	1.55	2,830	45.1	54	41	33	172
17	524	100	45	.0039	31.4	8.1	.70	140	3,220	7,410	5,320	2.62	1.10	1.86	3,560	54.4	60	47	41	152
18	525	100	46	.0045	25.8	5.8	.56	154	3,220	6,770	5,000	2.14	1.12	1.63	3,000	58.0	71	60	55	114
19	[1] 16	80	36	.0032	9.3	2.9	.26	292	1,580	2,630	2,110	1.26	.58	.92	1,480	27.8	68	60	60	112
19	650	80	32	.0040	9.7	2.4	.30	253	2,140	4,480	3,310	1.62	.92	1.27	1,370	43.5	76	71	64	89

[1] Commercial.

TABLE 52.—*Quality tests—Sitka spruce.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length.			Stretch.			Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
									Crosswise.	Lengthwise.	Average.	Crosswise.	Lengthwise.	Average.						
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
2	211	80	30	0.0034	13.4	4.0	0.45	262	2,950	5,400	4,170	2.24	1.14	1.69	1,990	35.4	66	58	53	123
5	263	100	51	.0044	28.6	6.5	.56	234	3,070	6,000	4,540	2.66	1.58	2.12	2,940	34.6	44	28	22	206
6	264	100	51	.0041	33.8	8.2	.66	195	3,120	6,700	4,910	2.26	1.44	1.85	3,280	38.1	38	23	18	221
7	265	100	42	.0034	24.2	7.0	.58	195	3,380	6,850	5,120	2.10	1.46	1.78	3,380	45.1	35	21	16	228
8	365	80	35	.0037	17.8	4.8	.51	246	2,930	5,400	4,160	3.32	1.56	2.44	2,040	33.2	77	65	57	101
9	366	80	39	.0041	18.1	4.4	.46	244	3,040	5,610	4,320	2.38	1.54	1.96	2,070	38.5	74	63	56	107
10	367	80	36	.0038	16.2	4.3	.45	240	2,860	5,240	4,050	2.74	1.44	2.09	1,960	37.5	72	62	56	110
11	368	80	39	.0043	17.0	4.0	.44	239	2,640	5,010	3,820	3.06	1.56	2.31	1,850	36.4	72	61	55	112
12	388	80	36	.0036	18.3	5.1	.51	.415	3,360	6,140	4,750	2.02	1.18	1.60	2,480	22.4	66	54	50	130
13	389	80	38	.0038	20.2	5.3	.53	294	3,490	6,120	4,800	2.34	1.12	1.73	2,560	30.8	71	60	53	116
14	370	80	33	.0035	16.2	4.6	.49	286	3,020	5,720	4,370	2.60	1.46	2.03	2,090	31.2	68	57	51	124
15	343	80	36	.0038	15.4	4.1	.43	335	3,200	5,760	4,480	1.86	1.26	1.56	2,250	31.1	71	59	50	120
16	324	81	32	.0032	15.4	4.9	.48	779	2,800	5,570	4,180	2.44	1.72	2.08	2,240	11.2	60	50	43	147
17	295	100	48	.0037	27.2	7.3	.56	429	3,190	6,160	4,680	2.76	1.76	2.26	3,460	19.5	35	21	16	228
18	325	80	26	.0027	10.6	3.9	.41	976	3,190	5,510	4,350	2.36	1.62	1.99	2,300	10.9	64	52	45	139
19	[1]3	75	40	.0034	9.8	2.9	.25	408	1,450	3,640	2,540	1.24	.98	1.11	1,720	24.9	65	60	60	115
19	446	80	33	.0040	12.6	3.2	.38	268	2,640	4,610	3,620	2.44	1.16	1.80	1,600	35.5	73	61	50	116

[1] Commercial.

TABLE 53.—*Quality tests—white birch.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length.			Stretch.			Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
									Crosswise.	Lengthwise.	Average.	Crosswise.	Lengthwise.	Average.						
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	237	80	32	0.0029	15.8	5.5	0.49	135	2,470	5,130	3,800	1.52	1.12	1.32	2,121	57.4	34	20	16	230
2	216	80	33	.0046	6.4	1.4	.19	596	1,660	2,630	2,140	1.34	.94	1.14	840	18.9	74	63	58	105
3	322	100	48	.0042	24.7	5.8	.51	150	2,580	4,600	3,590	2.96	1.26	2.11	2,310	46.7	36	22	16	226
4	278	100	52	.0049	24.0	4.9	.46	155	2,730	3,800	3,260	2.24	1.30	1.77	1,990	45.8	38	24	19	219
5	274	100	57	.0053	27.8	5.2	.49	152	2,950	4,880	3,920	2.72	1.24	1.98	2,300	52.5	39	24	19	218
6	425	80	34	.0046	9.8	2.1	.29	667	2,190	3,870	3,030	1.58	.92	1.25	1,280	15.7	69	59	54	118
7	427	80	34	.0046	8.6	1.9	.25	629	2,010	3,540	2,780	1.44	.76	1.10	1,110	17.7	66	56	60	118
8	426	80	35	.0049	8.7	1.8	.25	519	2,110	3,520	2,820	1.02	.66	.84	1,160	21.8	66	55	47	132
9	428	80	34	.0049	7.4	1.5	.22	512	1,810	2,900	2,360	1.10	.64	.87	930	21.0	73	60	53	114

TABLE 54.—*Quality tests—aspen.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length.			Stretch.			Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
									Crosswise.	Lengthwise.	Average.	Crosswise.	Lengthwise.	Average.						
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	234	80	32	0.0028	12.8	4.6	0.40	158	2,080	4,130	3,110	1.66	1.24	1.45	1,760	49.1	44	30	23	203
2	217	80	33	.0042	9.8	2.3	.30	464	2,240	3,880	3,060	1.70	1.10	1.40	1,340	22.0	73	63	56	108
3	262	100	61	.0049	28.2	5.7	.46	138	2,810	4,960	3,880	3.06	1.30	2.18	2,680	61.2	37	23	18	222
4	261	100	55	.0045	29.9	6.6	.54	131	3,290	5,850	4,570	2.72	1.32	2.02	3,140	64.6	36	23	18	223
5	260	100	63	.0052	32.2	6.2	.51	118	2,970	5,240	4,100	2.94	1.32	2.13	2,820	67.8	38	23	18	221
6	436	80	31	.0039	11.0	2.8	.36	870	2,760	4,970	3,860	1.48	.84	1.16	1,680	12.3	72	64	56	108
7	437	80	29	.0038	9.2	2.4	.32	690	2,460	4,120	3,290	1.20	.80	1.00	1,390	14.9	73	63	56	108
8	438	80	28	.0038	8.4	2.2	.30	606	2,440	4,250	3,340	1.24	.78	1.01	1,390	18.4	69	62	54	115
9	439	80	34	.0045	9.8	2.2	.29	559	2,240	3,500	2,870	1.58	.80	1.19	1,190	17.7	76	66	57	101
10	440	80	35	.0040	14.2	3.6	.41	1,040	2,690	4,870	3,780	1.52	1.04	1.28	1,780	8.8	72	60	50	118
11	441	80	32	.0039	12.0	3.1	.38	781	2,740	4,640	3,690	1.94	.98	1.46	1,680	12.4	73	60	53	114
12	442	80	33	.0041	12.2	3.0	.37	625	2,660	4,270	3,460	1.86	1.06	1.46	1,550	15.0	73	67	49	111
13	443	80	32	.0041	10.9	2.7	.34	509	2,640	4,490	3,560	1.48	.80	1.14	1,520	20.6	73	61	52	114

TABLE 55.—*Quality tests—black gum.*

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length.			Stretch.			Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
									Crosswise.	Lengthwise.	Average.	Crosswise.	Lengthwise.	Average.						
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	727	80	34	0.0043	10.3	2.4	0.30	870	2,190	5,130	3,660	1.18	1.00	1.09	1,520	14.0	76	68	64	92
2	732	80	35	.0045	9.7	2.2	.28	818	1,800	4,270	3,040	1.42	1.16	1.29	1,290	13.3	80	71	65	84
3	728	80	35	.0046	8.6	1.8	.25	567	1,860	3,950	2,900	1.38	1.00	1.19	1,160	20.5	80	72	66	82
4	629	80	37	.0052	9.5	1.8	.26	658	1,760	3,280	2,520	1.64	.86	1.25	1,090	14.7	81	74	70	75
5	738	80	33	.0048	8.6	1.8	.26	667	1,680	3,830	2,760	1.28	.96	1.12	1,040	15.9	76	66	64	94
6	651	80	43	.0055	10.8	2.0	.23	787	2,080	3,880	2,980	1.84	1.06	1.45	1,250	16.5	77	71	66	86
7	630	80	41	.0056	8.9	1.6	.22	777	1,540	3,000	2,270	1.56	.96	1.26	960	13.3	81	72	68	79
8	628	80	47	.0067	7.6	1.1	.16	465	1,210	2,110	1,660	1.34	.84	1.09	710	22.3	85	74	67	74
9	688	100	42	.0056	7.4	1.3	.18	401	1,410	2,460	1,940	1.22	.86	1.04	840	26.8	68	56	50	126
10	693	100	48	.0049	21.2	4.4	.44	190	2,370	5,460	3,920	1.86	1.40	1.63	2,260	47.0	45	33	31	191
11	695	100	43	.0043	18.0	4.2	.42	229	2,460	5,240	3,850	2.08	1.14	1.61	2,300	40.0	49	37	32	182
12	694	100	53	.0054	20.9	3.9	.39	207	2,560	4,890	3,720	2.58	1.42	2.00	2,050	46.1	50	38	33	179
13	656	80	44	.0060	6.5	1.1	.15	545	1,370	2,440	1,900	1.08	.90	.99	750	23.2	77	68	64	91
14	711	80	47	.0066	5.1	.8	.11	644	980	1,820	1,400	1.00	.66	.83	550	19.8	82	73	67	78

NOTE.—Pulp for No. 14 was made on a coarse-grit stone.

TABLE 56.—*Quality tests.*

MIXTURE OF WOODS.

Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test.				Schopper tests.								Tintometer indications.			
					Total.	Per 0.001 in. thickness.	Per pound.	Horsepower per ton divided by strength factor.	Breaking length. Crosswise.	Breaking length. Lengthwise.	Breaking length. Average.	Stretch. Crosswise.	Stretch. Lengthwise.	Stretch. Average.	Breaking weight per sq. mm. sectional area.	Breaking length per horsepower per ton.	Red.	Green.	Blue.	Black.
		Per ct.	*Pounds.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
50	312	100	42	0.0040	17.4	4.4	0.41	227	2,580	4,780	3,680	2.62	1.44	2.03	2,210	39.4	39	23	16	222
51	314	100	42	.0039	16.5	4.2	.39	273	2,360	4,560	3,460	2.28	1.58	1.93	2,060	32.5	42	44	17	217
52	313	100	49	.0044	19.6	4.4	.40	254	2,640	5,020	3,830	3.08	1.50	2.29	2,330	37.8	38	22	15	225
WESTERN YELLOW PINE.																				
20	407	80	32	0.0039	13.8	3.5	0.43	227	2,980	4,850	3,920	1.72	.90	1.31	1,720	40.2	79	66	57	98
21	424	80	34	.0042	12.6	3.0	.37	272	2,650	5,230	3,940	1.48	.96	1.22	1,680	39.2	75	64	54	107
22	410	80	35	.0045	13.5	3.0	.39	267	2,790	5,060	3,920	1.56	.84	1.20	1,650	37.7	70	59	52	119
23	411	80	31	.0038	12.8	3.4	.41	262	3,000	5,260	4,130	1.46	.82	1.14	1,780	38.5	70	59	51	120
24	406	80	32	.0041	11.4	2.8	.36	330	2,440	4,270	3,360	1.52	.90	1.21	1,380	28.3	67	54	45	134
25	412	80	32	.0041	11.4	2.8	.36	321	2,740	4,290	3,520	1.76	.80	1.28	1,490	30.4	69	56	47	128
26	413	80	36	.0046	13.6	3.0	.38	300	2,770	4,970	3,870	1.68	.92	1.30	1,700	34.0	68	55	47	130
WESTERN HEMLOCK.																				
15	404	80	31	0.0035	18.2	5.2	0.59	233	3,310	5,730	4,520	2.32	1.14	1.73	2,140	33.0	65	54	48	133
16	414	80	37	.0040	19.5	4.9	.53	272	3,390	6,510	4,950	2.14	1.20	1.67	2,480	34.4	64	54	47	135
17	415	80	35	.0036	21.2	5.9	.60	247	4,040	6,620	5,330	2.26	1.02	1.64	2,710	36.0	65	55	49	131

MONTANA LODGEPOLE PINE.																				
24	417	80	35	0.0040	13.8	3.4	0.39	299	2,520	4,760	3,640	2.76	1.48	2.12	1,760	31.2	58	47	40	155
25	416	80	36	.0042	15.4	3.7	.43	284	2,440	4,640	3,540	2.78	1.44	2.11	1,620	29.0	65	54	47	134
CALIFORNIA LODGEPOLE PINE.																				
22	418	80	35	0.0041	15.5	3.8	0.44	398	3,090	5,810	4,450	1.98	1.12	1.55	2,080	25.4	67	57	49	127
23	419	80	31	.0038	12.0	3.1	.38	388	2,770	5,120	3,940	2.02	1.06	1.54	1,770	26.7	67	56	49	128
24	420	80	30	.0035	13.3	3.8	.44	400	3,160	5,860	4,510	1.70	1.00	1.35	1,960	25.7	73	61	52	114
25	421	80	35	.0038	16.6	4.4	.48	346	3,290	5,820	4,560	2.16	1.02	1.59	2,290	27.5	69	58	51	122
GREEN BALSAM.																				
23	[1] 10	75	33	0.0029	8.4	2.9	0.26	368	1,820	3,460	2,640	1.12	.74	.93	1,690	27.6	63	57	57	123
23	453	80	33	.0040	14.2	3.5	.43	222	2,880	4,820	3,850	1.90	1.00	1.45	1,720	40.2	83	77	66	74
HEMLOCK.																				
63	[1] 9	75	36	0.0031	9.8	3.2	0.27	470	1,790	3,830	2,810	1.12	.84	.98	1,860	22.1	55	50	50	145
63	452	80	34	.0039	14.5	3.7	.43	296	2,940	5,100	4,020	1.82	1.00	1.41	1,870	31.7	78	66	60	96
TAMARACK.																				
54	[1] 12	75	36	0.0034	9.9	2.9	0.27	327	1,860	3,560	2,710	1.14	.78	.96	1,800	30.7	59	54	54	133
54	455	80	37	.0046	13.6	3.0	.37	238	2,520	4,580	3,550	1.78	1.06	1.42	1,650	40.2	77	66	61	96

[1] Commercial.

TABLE 57.—*Commercial runs.*

Stock No. of pulp.	Kind of wood.	Run No.	Kind of burr.	Number of pockets used.	Pressure on 14-inch cylinder.	Pressure per square inch of pocket area.	Revolutions per minute.	Peripheral speed.	Average horsepower to grinder.	Maximum horsepower to grinder.	Bone-dry pulp in 24 hours.	Horsepower per ton bone-dry pulp in 24 hours.	Solid rossed wood ground in 24 hours.	Weight per cubic foot bone-dry wood.	Average diameter of wood.	Moisture in wood.	Bone-dry pulp per 100 cubic feet solid rossed wood.	Efficiency of conversion.	Screenings per 100 cubic feet solid rossed wood bone-dry.	Average temperature of grinding.	Horsepower divided by pressure × speed.
					Lbs. per sq. in.	*Lbs.*		*Feet per minute.*			*Tons*		*Cu. ft.*	*Lbs.*	*In.*	*Per cent.*	*Lbs.*	*Per cent.*	*Lbs.*	*° F.*	
	Green jack pine	14	Diamond point, cut 6 to inch	3	50	20.5	171	2,400	436	....	7.030	64.3	......	......	....	......	2,170	85.5	......	148	0.00885
	Seasoned jack pine	14	....do	3	50	20.5	171	2,400	447	....	6.230	72.7	......	......	....	......	2,210	86.4	......	145	.00907
	Hemlock	14	Spiral, cut 10 to inch	3	50	20.5	175	2,435	349	447	3.417	103.1	334.0	24.8	....	57.18	2,048	82.6	10.6	171	.00699
	....do	14–1	....do	3	50	20.5	175	2,432	368	464	4.115	89.5	398.0	24.8	....	57.18	2,077	83.7	18.5	167	.00740
	....do	8	Straight, cut 10 to inch	3	40	16.4	176	2,450	306	426	3.435	89.7	328.0	24.8	....	57.18	2,083	84.0	20.3	168	.00762
	....do	23	Diamond point, 10 to inch	3	40	16.4	176	2,440	301	386	3.300	92.4	313.0	24.8	....	57.18	2,105	84.9	23.5	173	.00750
	....do	30	Spiral, cut 10 to inch; straight, cut 4 to inch.	3	40	16.4	176	2,432	331	392	3.725	89.5	355.0	24.8	....	57.18	2,102	84.7	17.0	177	.00833
	Hemlock Spruce	46A	Straight, cut 3 to inch; spiral, cut 12 to inch.	3	50	20.5	175	2,445	427	507	5.175	83.0	334.0 174.0	24.84 23.765	...	46.23 29.44	2,030	83.1	16.3	169	.00853
	Jack pine Hemlock Spruce	51	....do	3	50	20.5	175	2,445	443	528	5.575	79.4	160.0 190.0 150.0	25.6 24.7 29.11	...	37.16 45.93 26.98	2,232	83.2	17.4	171	.00884
	Jack pine	24	....do	3	40 45	16.4 16.46	175	2,445	395	....	4.305	91.8	388.0	25.60	....	37.16	2,220	86.7	14.86	176	.00924
	Spruce	1	....do	3	40 50	16.4 20.5	175	2,445	401	....	4.810	83.5	230.0 156.0	28.40	....	28.90	2,480	87.4	17.2	173	....
	Hemlock Jack pine	52	....do	3	50	20.5	175	2,445	414	494	4.310	96.3	386.0	25.20 26.75	...	47.17 32.50	2,230	86.2	17.6	178	.00825
	Hemlock	50	....do	3	50	20.5	175	2,445	418	484	4.370	97.5	405.0	25.0	....	46.90	2,160	86.1	11.2	180	.00833
	Spruce	2	....do	3	40	16.4	200	2,795	402	....	4.120	97.5	409.5	22.72	....	39.33	2,012	88.5	13.75	168	.01002
1	....do	222	....do	2	80	32.8	225	3,069	474	566	6.610	71.6	551.0	25.37	6¾	32.24	2,400	94.6	14.65	146	.00470
2	Western hemlock	18	....do	3	50	20.5	225	3,069	479	566	3.800	126.0	338.0	24.77	....	24.20	2,250	91.0	10.80	169	.00760
3	Sitka spruce	19	....do	2	80	32.8	225	3,069	458	541	4.495	102.0	435.0	23.00	....	22.60	2,065	89.9	32.50	166	.00455
4	Montana lodgepole pine.	26	....do	3	55	22.55	225	3,069	500	581	3.630	137.8	334.0	24.61	6½	25.00	2,175	88.3	12.20	173	.00723
5	Western yellow pine.	27	Spiral, cut 8 to inch; straight, cut 10 to inch.	3	40	16.4	225	3,069	455	541	7.055	64.5	635.0	24.67	10¾	26.98	2,220	90.0	30.20	137	.00904
6	Green balsam fir	22	....do	3	40	16.4	225	3,069	481	543	5.330	90.4	546.0	20.75	4⅞	60.40	1,950	94.1	8.45	151	.00955
7	California lodgepole pine.	26	....do	2	80	32.8	225	3,069	496	580	6.405	77.5	642.0	22.45	....	25.30	1,996	88.9	21.6	156	.00492
8	Red fir	19	....do	2	80	32.8	225	3,069	483	580	5.710	84.6	571.0	21.59	....	26.50	2,000	92.7	12.6	158	.00479

9	Spruce	63	do	3	50	20.5	225	3,069	516	592	4.075	127.0	179.0	24.93	5 1/8	33.55	2,280	92.1	12.00	177	.00820
	Hemlock												179.0	24.47	5 1/4	44.50					
10	Green balsam	23	do	3	40	16.4	225	3,069	476	542	4.980	95.6	254.0	20.30	5 1/4	61.66	2,160	96.2	11.50	157	.00945
	spruce.												209.0	24.93	5	33.55					
11	Tamarack	53	do	3	40	16.4	225	3,069	430	505	4.510	95.4	324.0	32.44	5 1/2	25.25	2,780	85.6	10.10	170	.00854
12	do	54	do	2	65	26.6	225	3,069	415	503	4.705	88.2	185.0	30.70	5 5/8	25.00	2,410	89.4	13.75	157	.00509
	Spruce												205.0	23.74	4 5/8	35.13					
13	Noble fir	16	do	3	50	20.5	225	3,020	393	504	4.275	92.0	442.0	21.05	(1)	34.80	1,933	91.9	14.8	151	.00636
14	Alpine fir	13	Spiral, cut 12 to inch; straight, cut 3 to inch.	3	50	20.5	225	3,020	430	579	5.110	84.0	479.0	21.60	7 3/8	43.00	......	.....	16.2	156	.00695
15	White fir	35	Spiral, cut 8 to inch; straight, cut 10 to inch.	3	45	18.5	225	3,020	384	477	4.775	80.4	498.0	20.80	(1)	20.58	1,920	92.2	16.4	162	.00687
16	Englemann spruce, Colorado.	19	do	2	70	28.7	225	3,020	368	479	4.840	76.0	488.0	21.17	6 1/2	58.26	1,980	93.6	12.8	153	.00425
17	Amabilis fir	15	do	2	80	32.8	225	3,020	397	502	4.900	81.0	485.0	21.10	(1)	25.27	2,020	95.7	10.3	159	.00401

[1] Split.

TABLE 58.—*Quality tests of papers made from "commercial" pulps.*

Stock No. of pulp.	Kind of wood.	Grinder run No.	Paper machine run No.	Ground wood in total furnish.	Weight per ream.	Thickness.	Mullen test: Total.	Mullen test: Per 0.001 in. thickness.	Mullen test: Per pound.	Mullen test: Horsepower per ton divided by strength factor.	Schopper tests: Breaking length: Crosswise.	Schopper tests: Breaking length: Lengthwise.	Schopper tests: Breaking length: Average.	Schopper tests: Stretch: Crosswise.	Schopper tests: Stretch: Lengthwise.	Schopper tests: Stretch: Average.	Schopper tests: Breaking weight per sq. mm., sectional area.	Schopper tests: Breaking length per horsepower per ton.	Tintometer indications: Red.	Tintometer indications: Green.	Tintometer indications: Blue.	Tintometer indications: Black.
				P. ct.	*Lbs.*	*Inch.*	*Points.*	*Points.*	*Point.*		*Meters.*	*Meters.*	*Meters.*	*P. ct.*	*P. ct.*	*P. ct.*	*Grams.*	*Meters.*	*Parts.*	*Parts.*	*Parts.*	*Parts.*
1	White spruce	222	444	80	32	0.0040	11.9	3.0	0.37	194	2,730	4,700	3,720	1.68	0.88	1.28	1,610	51.9	72	60	52	116
			[1] 1	75	32	.0029	8.8	3.0	.28	256	1,880	3,740	2,810	1.26	.82	1.04	1,760	39.2	65	59	58	118
2	Western hemlock	18	445	80	34	.0039	17.8	4.6	.52	242	3,000	5,720	4,300	2.80	1.46	2.13	2,080	34.6	64	52	45	139
			[1] 2	75	33	.0028	10.1	3.6	.31	406	2,430	4,290	3,360	1.36	.92	1.14	2,160	26.7	56	53	53	138
3	Sitka spruce	19	446	80	33	.0040	12.6	3.2	.38	268	2,640	4,610	3,620	2.44	1.16	1.80	1,600	35.5	73	61	50	116
			[1] 3	75	40	.0034	9.8	2.9	.25	408	1,450	3,640	2,540	1.24	.98	1.11	1,720	24.9	65	60	60	115
4	Lodgepole pine (Montana)	26	447	80	33	.0038	13.8	3.6	.42	328	2,840	4,940	3,890	2.34	1.48	1.91	1,820	28.2	71	57	46	126
			[1] 4	75	33	.0028	8.9	3.2	.27	510	1,870	3,980	2,920	1.20	.76	.98	1,980	21.2	60	54	54	132
5	Western yellow pine	27	448	80	36	.0048	9.4	2.0	.26	248	2,050	3,500	2,780	1.92	.92	1.42	1,150	43.1	74	62	51	113
			[1] 5	75	32	.0033	5.4	1.6	.17	379	1,150	2,710	1.930	.78	.74	.76	1,040	29.9	61	56	56	127
6	Balsam fir	22	449	80	34	.0043	13.2	3.1	.39	232	2,640	4,650	3,640	2.16	1.18	1.67	1,580	40.3	80	69	60	91
			[1] 6	75	30	.0028	6.8	2.4	.22	410	1,680	3,140	2,410	.96	.70	.83	1,520	26.7	70	65	65	100
7	Lodgepole pine (California)	26	450	80	34	.0050	9.6	1.9	.28	277	2,230	3,750	2,990	1.68	.94	1.31	1,120	38.6	75	62	55	108
			[1] 7	75	34	.0034	7.4	2.2	.22	352	1,450	2,740	2,100	1.32	.80	1.06	1,320	27.1	62	57	57	124
8	Red fir	19	451	80	33	.0043	10.8	2.5	.33	256	2,650	4,150	3,400	2.00	1.08	1.54	1,450	40.1	70	55	51	124
			[1] 8	75	34	.0034	9.9	2.9	.29	292	1,850	3.550	2.700	1.52	.96	1.24	1,660	31.9	58	54	53	135
9	Hemlock (one-half spruce)	63	452	80	34	.0039	14.5	3.7	.43	296	2,940	5,100	4,020	1.82	1.00	1.41	1,870	31.7	78	66	60	96
			[1] 9	75	36	.0031	9.8	3.2	.27	470	1,790	3.830	2,810	1.12	.84	.98	1,860	22.1	55	50	50	145
10	Balsam fir (one-half spruce)	23	453	80	33	.0040	14.2	3.5	.43	222	2,880	4,820	3,850	1.90	1.00	1.45	1,720	40.2	83	77	66	74
			[1] 10	75	33	.0029	8.4	2.9	.26	368	1,820	3,460	2,640	1.12	.74	.93	1.690	27.6	63	57	57	123
11	Tamarack	53	454	80	37	.0045	12.0	2.6	.32	298	2.250	3,950	3,100	1.54	.98	1.26	1,490	32.5	76	63	56	105
			[1] 11	75	35	.0033	7.4	2.2	.21	454	1,640	2,960	2,300	1.10	.72	.91	1.400	24.1	52	46	46	156
12	Tamarack (one half spruce)	54	455	80	37	.0046	13.6	3.0	.37	238	2,520	4,580	3,550	1.78	1.06	1.42	1,650	40.2	77	66	61	96
			[1] 12	75	36	.0034	9.9	2.9	.27	327	1,860	3,560	2.710	1.14	.78	.96	1,800	30.7	59	54	54	133
13	Noble fir	16	647	80	34	.0035	16.6	4.8	.49	188	3,370	6,240	4,800	1.96	1.04	1.50	2,610	52.2	72	65	60	103
			[1] 13	80	35	.0028	12.6	4.5	.36	256	2,260	4,630	3,440	1.60	.96	1.28	2,710	37.4	63	56	55	126
14	Alpine fir	13	640	80	35	.0043	12.3	2.9	.35	240	2,830	5,120	3,980	1.70	1.06	1.38	1,720	47.4	76	70	67	87
			[1] 14	80	33	.0029	9.2	3.1	.28	300	1,670	3,020	2,340	1.16	.68	.92	1,680	27.8	68	61	63	108
15	White fir	35	649	80	33	.0041	8.2	2.0	.25	322	2,070	3,510	2,790	1.32	.78	1.05	1,220	34.7	75	66	58	101
			[1] 15	80	34	.0033	7.2	2.2	.21	383	1,420	2,840	2,130	1.18	.80	.99	1,370	26.5	62	57	55	126
16	Engelmann spruce (Colorado)	19	650	80	32	.0040	9.7	2.4	.30	253	2,140	4,480	3.310	1.62	.92	1.27	1,370	43.5	76	71	64	89
			[1] 16	80	36	.0032	9.3	2.9	.26	292	1,580	2,630	2,110	1.26	.58	.92	1,480	27.8	68	60	60	112
17	Amabilis fir	15	653	80	33	.0038	13.8	3.7	.42	193	2,770	5,130	3,950	2.74	1.38	2.06	2,070	48.7	72	63	59	106
			[1] 17	80	36	.0033	10.2	3.1	.28	290	1,870	3,700	2,780	1.28	.74	1.01	1,860	34.3	68	61	60	111

[1] News.

APPENDIX B.

(Containing the following paper samples.)

Kind of wood used.	Untreated wood.			Cooked wood.
	Grinder run No. (Exp. paper).	Stock No. Unprinted news.	Stock No. Printed news.	Grinder run No.
White spruce	222	1	1	190
Western hemlock	18	2	2	9
Sitka spruce	19	3	3	6
Lodgepole pine (Montana)	26	4	4	14
Western yellow pine	27	5	5	8
Balsam fir	22	6	6	27
	23	10	10	
Lodgepole pine (California)	26	7	7	1
Red fir	19	8	8	2
Hemlock	63	9	9	[1]61
Tamarack	53	11	11	27
	54	12	12	
Noble fir	16	13	13	11
Alpine fir	13	14	14	12
White fir	35	15	15	[2]24
Engelmann spruce (Colorado)	19	16	16	14
Amabilis fir	15	17	17	10
Jack pine	27			30
White pine	8			11
Aspen	2			3
Birch	9			5
Black gum	3			10
Loblolly pine (fall cut)	6			19
Loblolly pine (spring cut)	28			18
Lowland fir	13			2
Engelmann spruce (Montana)	16			10
Western larch	8			1

[1] Or No. 62. [2] Or No. 10.

White Spruce.

Grinder Run No. 222.

Western Hemlock.

Grinder Run No. 18.

Sitka Spruce.

Grinder Run No. 19.

Lodgepole Pine. --- Montana..

Grinder Run No. 26.

Western Yellow Pine.

Grinder Run No. 27.

Balsam Fir.

Grinder Run No. 22.

Balsam Fir.

Grinder Run No. 23.

Lodgepole Pine. --- California.

Grinder Run No. 26.

Red Fir.

Grinder Run No. 19.

Hemlock.

Grinder Run No. 63.

Tamarack.

Grinder Run No. 53.

Tamarack.

Grinder Run No. 54.

Noble Fir.

Grinder Run No. 16.

Alpine Fir.

Grinder Run No. 13.

White Fir.

Grinder Run No. 35.

Engelmann Spruce --- Colorado.

Grinder Run No. 19.

Amabilis Fir.

Grinder Run No. 15.

Jack Pine.

Grinder Run No. 27.

White Pine.

Grinder Run No. 8.

Aspen.

Grinder Run No. 2.

Birch.

Grinder Run No. 9.

Black Gum.

Grinder Run No. 3.

Loblolly Pine --- fall cut.

Grinder Run No. 6.

Loblolly Pine --- Spring Cut.

Grinder Run No. 28.

Lowland Fir.

Grinder Run No. 13.

Engelmann Spruce --- Montana.

Grinder Run No. 16.

Western Larch.

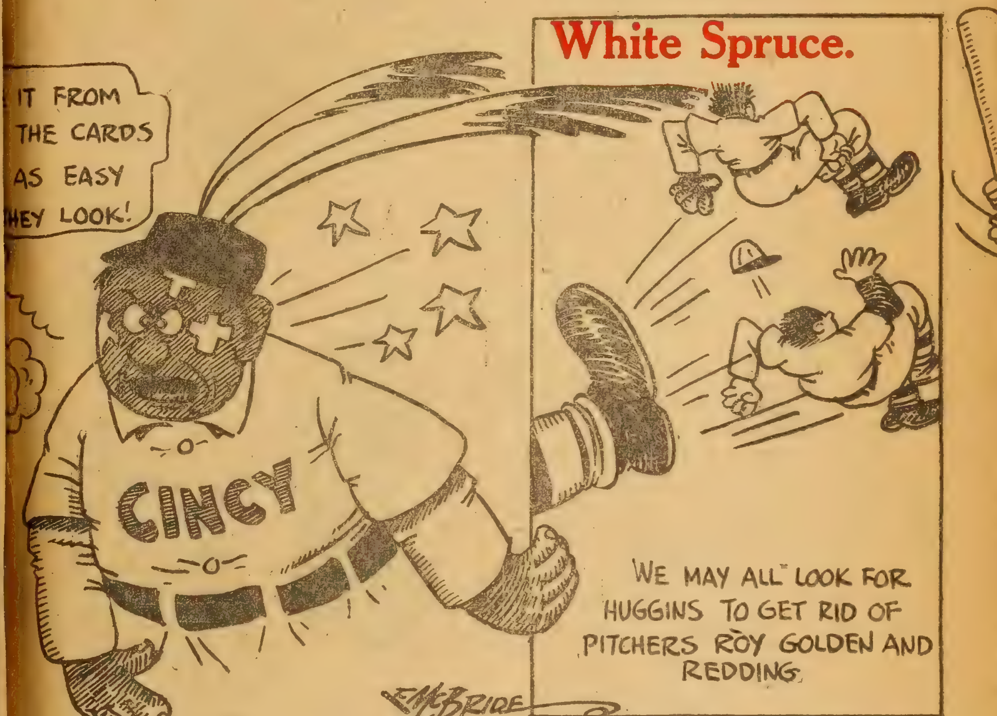
Grinder Run No. 8.

Stock No. 1.

White Spruce.

AND OTHER SP

S—*HARRY SALLEE PICKLES THE PILL—HUGGINS' MEN L*



Vin Three Out of Four From Reds

Tinker's Men on Their Heads After First

bard Three Cincinnati Twirlers

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looking for right off the reel. "Reb" Oakes punched a single to center, scoring Mowrey and Sheckard. Marsans tossed the ball home and Oakes grabbed second. Gee, how those Red outfielders love to zing the ball around! O'Leary walked. Joe Tinker danced the highland fling in the middle of the diamond.

"You're wilder than Powell," shouted "Tink" to his pitcher.

"Don't bawl me out, that's something I can't stand," replied Works.

"Well, if I can't bawl you out, I ...

fundo voice back of the Reds' bench.

"I'd like to climb into the stand and choke you to death," said "Tink."

"Gee, but you're a nice, mild, gentle sort of an animal," said the bass drummer as he fled to a safer spot.

Harry Sallee spanked the leather savagely all afternoon. Harry and "Tink" led their respective teams with the big stick. "Tink" got three rousing wallops and the "Higginsport Huckleberry" also hit the center of the bull's-eye three times.

"Sal" started ...

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Carnegie Is Coming Here For Peace Talk Thursday; College Contest To-Night

Other Distinguished Guests Arriving—Lineal Descendant to Unveil Jefferson Statue.

Distinguished guests who will participate in the dedication of the Jefferson Memorial building, the unveiling of the Jefferson statue and the deliberations of the Fourth American Peace Congress already are arriving in St. Louis.

Andrew Carnegie, who will deliver an address Thursday afternoon at the session of the Peace Congress, is expected to reach St. Louis to-morrow afternoon or Thursday morning. He will be accompanied by Mrs. Carnegie. They will be the guests while in St. Louis of Robert S. Brookings at his home on Lindell boulevard.

Miss Natalie Norton of Elsberry, Mo., a lineal descendant of Thomas Jefferson, was chosen yesterday to unveil the Jefferson statue. Miss Norton is the daughter of Porter Norton of Elsberry.

The first of the Peace Congress ceremonies, which will continue throughout the week, will be to-night in the Sheldon Memorial Auditorium. This is the Missouri oratorical contest of the Intercollegiate Peace Association.

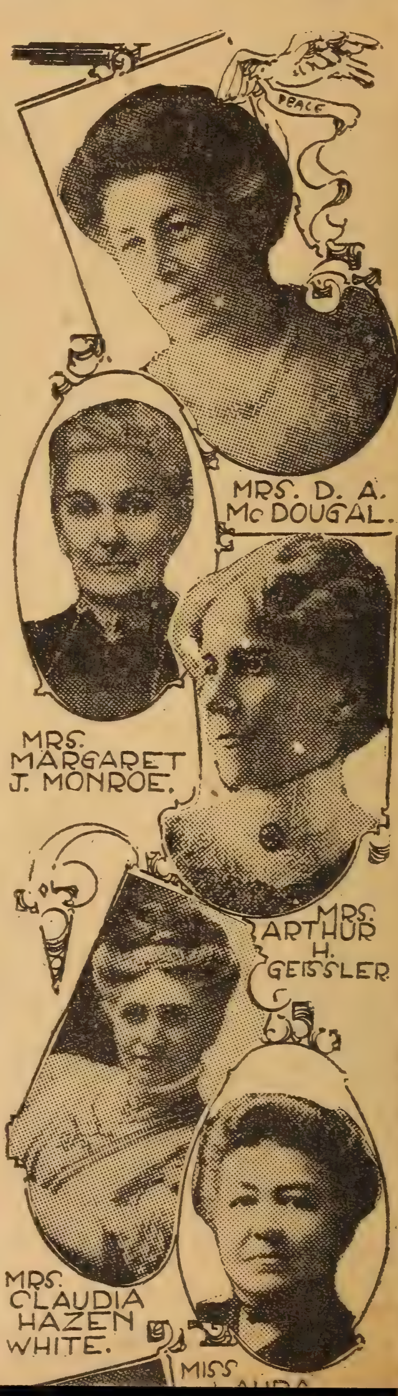
Former Judge Selden P. Spencer will preside. A student from each of six Missouri colleges will compete. The first prize of $75 is offered by the Intercollegiate Peace Association, and the second prize of $50 is offered by the American Peace Congress.

Tierney St. Louis U. Orator.

Central College, at Fayette, will be represented by Edward Verson Nash, who will speak on "Our Relation to Peace." John Leo Tierney of St. Louis University will speak on "International Peace." George C. Wilson of the University of Missouri will speak on "They, Too, Are Brothers."

Washington University will be represented by R. J. Puchschmidt, whose oration is entitled "The Justice and Honor of Nations." Westminster College, at Fulton, is represented by Sidna Poage Dalton. His subject is "The Demand for International Peace." William Jewell College, at Liberty, will be represented by Frank R. Birkhead, who will have for his subject "War, the Sum Total of Wretchedness."

More than 1,000 delegates from all sections of the country and many distinguished persons from abroad will at-



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Dr.

Stock No. 2.

Western Hemlock.

MPBELL DENIES
IE FAVORS CARTER

s That He Is Not Now Available to Head National Bank of Commerce.

(NAME PRESIDENT TO-DAY

idolph, Acting Chief, Remains Most Likely Candidate for Vacancy.

e National Bank of Commerce di-
ors to-day will have their first
ting since the special session of
Thursday, when the resignation of
F. Edwards from the presidency
he institution was announced.
is within the power of the board
ill the vacancy at this meeting by
ing a successor to Mr. Edwards.
ons in close touch with the situa-
believe that while the matter will
e up for discussion, no action will
taken, and some predict the new
utive will not be chosen until next

m Randolph, vice president of the
merce, and who is serving as
ident, apparently remains the like-
possibility of those who have
mentioned in connection with the
e.

ports persistently circulated that
es Campbell, leading director of
Mercantile Trust Company and a
merce director, favored W. Frank
ter for the place yesterday, were
ared by Mr. Campbell to be with-
foundation.

rticle Absolutely Unauthorized.

hat article is absolutely unauthor-
," said Mr. Campbell when a posi-
assertion in an afternoon paper
t Carter was slated to be head of
Louis' largest bank was shown him.
ter now is vice president of the Mercan-
tile Trust Company.

Would Mr. Carter be agreeable to
as president of the Bank of Com-
ce?" was asked.

He would be an admirable man for
place," said Mr. Campbell, "but he
not now available. This matter of
osing a new president never has
e up at a board meeting, and only
been discussed among a very few.
This is not a matter of personal pref-
nce or friendship, but rather one of
osing the best possible man for the

Western Hemlock.

Stock No. 2.

CHEMICAL CONCERN LOSES ITS CHARTER

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Stock No. 3.

Sitka Spruce.

RECORD OF BIRTHS

Boys.

and A. Alles, 5609 Michigan.
and S. Bahr, 8424 Pennsylvania.
and L. Lewis, 3021 Rauschenbach.
and M. Juch, 4431 Penrose.
and C. Knaus, 443 Wilmington.
and D. Jaffke, 4633 S. Grand.
and A. Leibinger, 4327A Clayton.
and A. O'Connell, 5219 Theodosia.
and A. Langer, 4205 Warne.
and E. Evans, 1806 Nebraska.
and A. Schutt, 2352 Arkansas.
and M. Seville, 1842 S. Fourteenth.
and M. Fischer, 4563 N. Broadway.
and M. Murray, 3501 Grace.
and C. Wenc, 1418 N. Ninth.
and K. Schuermann, 2906 Palm.
and M. Rogers, 4207 Fair.
and N. Etz, 2804 Market.

Girls.

and I. Hanneck, 2629 Gravois.
and H. Hoffman, 2314 La Salle.
and A. Vogel, 3634 Tholozan.
and M. Mowrey, 2903 Sullivan.
and L. Hiselmeyer, 4331 N. Broadway.
and M. Weston, 4816 Washington.
and B. Stevens, 1016 S. Eighth.
and A. Spencer, 6214 Washington.
and B. Odenwalder, 2609 S. Eighteenth.
and A. Zibb, 1040 Emmet.
and A. Mundweller, 2018 Menard.

MARRIAGE LICENSES

Lonzo Alford Gales.....2645 Pine
Annie Snapps.....2645 Pine
Carl Ullman.....6276 Wilson
Ethel Vosburg.....1916 Knox
Gilbert Cox.....3513 Bell
Mabel Frederick.....2735 Wyoming
Marcus Roscoe Cutler.....Moweaqua, Ill
Grace Gilliland.....Moweaqua, Ill
George H. Bliss.....Chicago, Ill
Nell M. Stanton.....2810 Eads
John Lehen.....721 Lami
Pauline Schwald.....East St. Louis, Ill
ll Lillard.....Natchez, Miss
ry Griffin.....Natchez, Miss
Charles J. Lusch.....2639 January
Edith Wood.....Alton, Ill
Edwin E. R. Schellenberg.....1523 S. Seventh
Mrs. Emma Lehrmann.....1523 S. Seventh
Jesse D. Veatch.....5667 Von Versen
Helen S. Butler.....6039 Suburban
Walter Seim.....3722 Texas
Nellie O'Connell.....4468 McPherson
Charles Ketchum.....Taylorville, Ill
Malinda Durbin.....Taylorville, Ill
Henry Spies.....Donaldson, Ill
Hemma Umphres.....Donaldson, Ill
Victor Louis Huber.....4817 Goethe
Christine Gronewald.....5737 Kennerly
Philip Trost.....2911 Arsenal
Antonja Bratoz.....2911 Arsenal
Peter Carpiw.....153 St. George
Mrs. Katherina Slipec.....156 St. George
August H. Hofeldt.....Chicago, Ill
Lydia B. Haskell.....Maplewood, Mo
Ralph E. McAninch.....Cleveland, O
Elsie M. Swain.....Kinmundy Ill
Gilbert P. Strelinger.....Detroit, Mich
Marguerite D. Stevenson.....4622 Westminster
Mateysz Sawucju.....1428 N. Ninth
Eleonora Stolarczyk.....1425 N. Ninth
Nelson H. Brown.....3012 Clark
Mrs. Cora A. Bohn.....4224 Papin
Arthur R. Clarkson.....1525 Marcus
Louise Scheuermann.....1811 N. Leffingwell
Fletcher D. Asbury.....Dallas, Tex
Mrs. Marie K. Kelly.....3955 Ashland
Otto G. Goewert.....2327 Rauschenbach
Elizabeth Kutz.....1308 North Market
Tom Caquatto.....Panama, Ill
Elizabetta Battu.....Panama, Ill
Clarence Wobbe.....2612 N. Nineteenth
Irene Ottensmeyer.....1444 Dodier
Henry Zurmuehlen.....4400 Vista
Gusta Schwanz.....Tipton, Mo
Frank L. Bartlett.....Griggsville, Ill
Lena L. Wilkinson.....2704 Geyer
Constans Olzevski.....1407 N. Ninth
Rozialia Rogavska.....1420 N. Ninth
Dee Roy Simons.....Madison, Ill

MARRIAGE AND DEATH NOTICES.

Marriage and Death Notices inserted in The Republic will be forwarded by telegraph to any one or all of the morning papers named below for simultaneous publication, without extra charge, if a request to do so accompanies the copy. Notices received after midnight cannot be forwarded, however, until the next evening:

Syracuse-Post-Standard. Providence Journal.
Chicago Record-Herald. Pittsburg Dispatch.
Cleveland Plain Dealer. Rochester Herald.
St. Paul Pioneer Press. Washington Post.
Minneapolis Tribune. Buffalo Courier.
Cincinnati Enquirer. New York Times.
Philadelphia Public Ledger. Boston Globe.

DEATHS.

HARRISON—Entered into rest on Monday, April 28, 1913, William I. Harrison, aged 55 years.

Funeral from George N. Lynch's undertaking parlors, 2229 Olive street, at 1 p. m., April 29. Interment private.

KUHN—Entered into rest, suddenly, on Sunday, April 27, 1913, at 10 o'clock p. m., Lucy Kuhn, beloved daughter of Emil and Emma Kuhn, sister of Olga and Ferdinand Kuhn, aged 19 years 4 months and 6 days.

Funeral will take place from the family residence, 2462 Plover avenue, on Wednesday, April 30, at 9:30 o'clock a. m., to Church of the Nativity (Walnut Park), thence to Calvary Cemetery. Friends are respectfully invited.

MILLER—Entered into rest on Monday, April 28, 1913, at 4:25 p. m., Christine Miller (nee Lauthauser), dear mother of Christine Sutton (nee Miller), Kate Stelzer (nee Miller), Louisa Bohley (nee Miller), Theophilus Miller and Emil Miller, and our dear sister, sister-in-law, mother-in-law and grandmother, at the age of 62 years.

Funeral Wednesday, April 30, at 2 p. m., from residence, 3340A Ohio avenue, to SS. Peter and Paul Cemetery. Interment private.

MITCHELL—Entered into rest, Monday, April 28, 1913, at 6:30 a. m., after a lingering illness, William P. Mitchell, beloved son of Mrs. Susan Mitchell Mott (nee Hobbins) and the late John Mitchell, and dear brother of Mrs. J. E. Barclay, John, Frank, Clarence, Irene, Helen, Loretto, Michael and Joseph Mitchell.

Funeral will take place from residence, 314 Chouteau avenue, Wednesday, April 30, at 8:30 a. m., to Immaculate Conception Church, thence to Calvary Cemetery. Friends of family invited to attend.

Deceased was a member of Peace Lodge, No. 109, B. of L. F. and E.

POHLE—Entered into rest Saturday, April 26, 1913, at 11 p. m., Julius Pohle, dearly beloved husband of Margarete Pohle (nee Fishback), dear father of William, Harry, Gertrude and Violet Pohle, our dear broth-

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	@⅞ b	55⅝ s
	56¾ s	56¼ s
	34⅝	34½ s
	34⅜ b	34⅛@¼
	34¼	34 b
	45	19.62
	50@52	19.67
	30@32	19.47
	85 s	10.90
	80 s	10.82 b
	77@80 b	10.85 b
	22 s	11.30
	90 s	10.95 b
	72@75	10.77@80

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	Closing Prices.	
	il 28.	April 26.
	90⅝ s	89¾@⅞ s
	06	1.06¾
	6	1.06⅞
	94	93⅞
	93½	93¾

FAIR ADVANCE IN WHEAT AND CORN

Crop News Favorable, but Statistics Help Buying Side—Oats Unchanged.

ST. LOUIS FUTURE PRICES.

	Closed Saturday.	Ranged Yesterday.	Closed Yesterday.
Wheat—			
May	92⅜@½ a	92½@92¾@⅞	92¾@⅞ a
July	89½ a	89⅞@90¼	90⅛ b
Sept.	89¼	89¾@90@⅛	90@¼ b
Corn—			
May	54½ a	54⅞@½@55	55 b
July	55⅛	55½@55¾	55¾ a
Sept.	55¾ a	....@....	56 b
Oats—			
May	33⅝ a	....@....	33⅝ b
July	33½@⅝ a	....@....	33¾ b
Sept.	33½ a	....@....	34⅛ a

Cables were irregular, but Liverpool closed higher on a less favorable European political outlook and largely on the strength of this wheat was on the upturn in the local market. News in this country was mainly favorable, both in the winter and spring belts, but there were decided signs of manipulation by the bull crowd at Chicago and little attention was paid to anything but the Chicago blackboard.

There were reported sales for export at the various domestic centers, but nothing startling and primary receipts for the day were enormous, 1,369,000 bu., comparing with only 530,000 bu. a year ago. Statistics showed up mildly bullishly, but the decrease in the domestic visible was not large for this season and weather in all directions was all that could be desired.

May wheat, which opened a split higher at 92½c, sold up to 92¾@⅞c, where it closed, thus recording an advance for the day of ⅜c. The more distant deliveries were correspondingly firm and on the upturn, July wheat ranging from 89⅞c to 90¼c and closing ⅝c higher at 90⅛c, and the Sept. delivery closing ¾@⅞c higher at 90@¼c bid.

Strength extended as well to the market for cash wheat. Offerings were liberal, 19 cars of soft winter and 49 cars of hard winter, but there was a brisk demand and prices were higher, especially on hard winter, which was taken by local and outside mills, mainly the latter, at an advance of ½c to 1c. Several cars of soft winter were offered and selections sold at $1.12 to $1.12¼. Southern Illinois mills picked up the choice.

Elsewhere the cash demand was good. Minneapolis reported an active cash market, with Chicago houses the best buyers, and No. 1 Northern selling at a premium of 2½c over May. The flour demand was better. Kansas City and Chicago reported good buying, with the latter city claiming some goodly sales for export. Winnipeg wired that the cash demand there was better.

Minneapolis stocks decreased 175,000 bu. for two days this week and a wire from that point said that seeding is

MANY ISSUES SET
ON EUROPEAN

Havoc Played With Berlin, Par flected in Disturbance at O Tendency After First Ha

NEW YORK, April 28.—Austria's erally delicate political situation in A kets of Berlin, Paris and London to-d This condition was reflected in no market and resulted in a new leve issues. The copper shares were th Copper losing 1⅛ points on the very

The first half hour, however, saw remaining after last week's persist rest of the day the tendency was to

Prices, to be sure, did not rally particularly hopeful sign that on th trading grew very dull. Nevertheless movement plainly had run its course

The pressure against the investr of the class of Northwestern, Grea tinctly firmer.

New York Central rallied well in Lake Shore notes had been sold in Lo new obligations put out by the Van

ABSENCE OF LIQUIDATION

There were fairly reassuring symp of further liquidation in the bond m like the Erie convertibles, the Interb Railways 5s were noticeably weak, b higher rank were done at the improv

Had it not been for the fear of t our market probably would have ha tions toward the end of the sessio play of weakness on the foreign s developments have become of gre corporate borrowing has begun to

Several of the tobacco stocks From the high of the year, Amer Lorillard and G. W. Helme show a can Tobacco this afternoon rallied

RESISTANCE OF STEEL

The resistance of Steel to profess points of the market for the last t small. This morning it broke below out under that figure. It is no dou outlook for a very favorable March mates from Pittsburg of the net ear would be a new high record for the

The general feeling is, however, $38,000,000.

The $50,000,000 railroad investmen proving to be a big toy for the Reb miles of the line are being operated President Randolph wanted to make fare.

The Rebels have free week-end jo all the population of the towns get the road as fast as they can go. So the first time since 1908.

firm. Sales: 350 sks. hard clear to arrive a $3.85 jute, 155 bbls. soft patent (direct or der by local mill) at $5.75 wood, 2 cars do by Southern Illinois mill at $6 wood; and for export—2,000 sks. (110s) hard clear to the Continent, 500 sks. hard patent to United Kingdom.

Quote in jute sks.: Soft—Patents at $4.45 @4.75; straights at $4.25@4.45; extra fancy at $3.70@3.85; fancy at $3.15@3.30; low grades at $2.60@2.90. Hard—Patents $4.15 @4.25; straights $3.90@4.10; first clears $3.15@3.30; second clears at $2.85@3; low

Stock No. 4.

Lodgepole Pine. --- Montana.

Stops Mother About to Throw Treasure in Garbage Can.

DECATUR, Ill., April 28.—Wayne Uhrich, 8-year-old son of Walter Uhrich, a barber, was responsible for the discovery of $3,000 in gold in two small cans contained in a larger can in the coal shed last week.

The small boy's curiosity alone prevented his mother throwing the can into the garbage heap, and Uhrich when they moved recently would have abandoned the old trunk containing the cans without looking into it.

His wife advised him to keep it because of sentiment, the trunk belonging to his father, who died in 1907. Yesterday the boy prevailed on his father to open it, and $5 and $10 gold pieces were found, neatly wrapped in paper.

PLOT AGAINST KAISER BARED

Berlin Police Warned of Proposed Attempt on Emperor's Life.

BERLIN, April 28.—A warning that an attempt was to be made on the life of Emperor William during his visit to Karlsruhe, Baden, was received yesterday by the police authorities in Berlin, anonymously, from abroad.

They immediately informed the police of Karlsruhe and Frankfort, and stringent precautions were taken to prevent any outrage.

PIERCE MAKES A DENIAL

Testimony in Hearing Did Not Reflect on Eben Richards.

To the Editor of The Republic.

The statement in issue of April 26, that "Pierce testified son-in-law signed his name without his knowledge," and "Eben Richards, son-in-law of Henry Clay Pierce, signed Mr. Pierce's name without the latter's knowledge or consent as guarantee for loans aggregating $2,100,000," is absolutely untrue and is cruelly hurtful to Mr. Richards and myself. There is no foundation for your statement in the official notes of my testimony before Commissioner Muench, wherein I stated as follows:

When Mr. Thompson was loaning his securities to Mr. Van Blarcom and I was loaning my securities to Mr. Van Blarcom, and at the request of Mr. Van Blarcom, with the full knowledge of all the officers of the National Bank of Commerce, my son-in-law, Mr. Richards, joined in my name with Mr. Van Blarcom in guaranteeing the National Bank of Commerce the purchase of $[illegible],000 Tennessee Central Railroad general mortgage bonds at the end of a year. Under just what circumstances I do not recollect now my guarantee with Mr. Van Blarcom was also given to the Mississippi Valley Trust Company for $600,000.

During the past many years Mr. Richards has held my full power of attorney, and now holds it.

Please conspicuously publish this letter in full in your to-morrow's issue.

H. C. PIERCE.

St. Louis, April 28.

Attorneys Moses N. Sale, Jesse McDonald, Lee Meriwether and Glendy B. Arnold, for the Democrats, and Selden P. Spencer and George B. Webster, for the Republicans, will hold a conference soon to agree upon the plans for the general recount of the ballots of the entire city.

An order directing the Election Commissioners to open the ballot boxes in the Eighth Ward has been issued by Judge George C. Hitchcock of the Circuit Court.

It was issued on the application of Rudolph Schneider, defeated Republican candidate for the House, who has laid claim to the seat occupied by James F. Ford, Democrat.

BOND ELECTION IN FALL

Free Bridge Committee to Consider Building of Approaches Before Then.

There is little chance that the special free bridge bond election will be held before September. The Election Commissioners have informed Mayor Kiel that the election could not be held until July at least.

The Mayor is opposed to holding the election in midsummer, as many voters will be away on vacations, so the election probably will be postponed until after vacation time.

The Joint Free Bridge Committee of the Municipal Assembly will convene again Thursday afternoon to discuss the advisability of selecting an approach to the bridge before the election.

Roommate Found Dead in Bed.

Oscar P. Hoffman, 36 years old, a hatmaker, was found dead in bed Sunday by his roommate, George H. Parsons, at 3119 Olive street. The physician summoned said death was due to carbolic acid poisoning. An inquest will be held this morning.

agreed. The case was brought here to reverse an order of Judge Bird that he be turned over to his uncle. The writ was made returnable in thirty days, when the matter will be heard on its merits.

The Court denied the writ of prohibition sought by Jean Lassance of Paris, France, to prevent Judge Hugo Grimm of the St. Louis Circuit Court from entertaining any further an appeal from a decision of the Probate Court of St. Louis in the final distribution of the estate of Peter Petz, deceased.

Lassance was one of the heirs to the estate and objected to this. The estate is inventoried at $23,719, and Lassance's share under the distribution and will is $1,310.

Following is a partial list of the motions disposed of and the other proceedings in the court in banc to-day:

Gold Issue Mining and Mineral Company, resp., vs. Pennsylvania Fire Insurance Company of Philadelphia., app.; respondent's motion to transfer to St. Louis Court of Appeals; appellant's suggestion in opposition to motion to transfer; motion overruled.

William P. Houston, resp., vs. Pulitzer Publishing Company, app.; appellant's motion to tax cost of printing abstract of record allowed for $81.

Floyd D. Jakson, plf., resp., vs. Edward Butler et al., def., app.; defendant appellant's motion to tax cost of printing abstract of record allowed for $94.50.

State ex rel. Tebbetts, rel., vs. Holtcamp, Judge; relator's motion to amend and affidavit in support; motion to amend sustained.

State ex rel. Circuit Attorney, rel., vs. Joseph A. Wright, resp.; respondent's motion to strike out certain statements from relator's reply; taken with case.

State ex rel. Joseph A. Wright, rel., vs. McQuillin, Judge, resp.; application of Eliza P. O'Hara for leave to file brief; leave granted.

State ex rel. Tebbetts vs. Holtcamp, J.; in the matter of Letitia Todd Breck vs. Rickarts et al.; argued and submitted together, with petitioner's reply to return of respondent filed in 17483.

MARRIAGE OF GIRL, 17, VOID

Foster Mother Refuses to Let Young Wife Live with Husband.

The marriage of Cora Berger, 17 years old, and Otto Berger, whom she was persuaded to marry when she was 15 years old, was annulled by Circuit Judge McQuillin yesterday.

A woman in whose bakery the girl was employed induced her to marry Berger, a baker at the place, she stated. The marriage took place at St. Charles. The woman for whom the girl worked accompanied her and Berger.

They returned to St. Louis immediately after the marriage and called at the home of the girl's foster mother, Mrs. Henry Duewel, of 3227 Hickory street. Mrs. Duewel would not let the girl live with Berger.

Robbed, Thrown from Eads Bridge.

Adam J. Dettling, who says he is an engineer of Bonne Terre, Mo., was found by Patrolman Brosnahan of the Carr Street Station on the levee last night, with his clothes dripping wet. He said three footpads robbed him of $4.50 and threw him off Eads Bridge into the Mississippi. He was held at the City Dispensary. Dettling was well clothed and wore a gold watch and a heavy gold ring.

sembly up to this point to chose a Speaker, owing to sharply drawn party issues, is a sufficient obstacle to delay the execution of the instructions.

Notwithstanding the advantage that might be gained by an immediate recognition, it is believed here that the

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the basis of investigation will be moved to Granite. To-day's witnesses all commend the management of the institution.

BOY, 8, FINDS $3,000 GOLD

Stops Mother About to Throw Treasure in Garbage Can.

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To the Editor of The Republic.

The statement in issue of April 26, that "Pierce testified son-in-law signed his name without his knowledge," and "Eben Richards, son-in-law of Henry Clay Pierce, signed Mr. Pierce's name without the latter's knowledge or consent as guarantee for loans aggregating $2,100,000," is absolutely untrue and is cruelly hurtful to Mr. Richards and myself. There is no foundation for your statement in the official notes of my testimony before Commissioner Muench, wherein I stated as follows:

> When Mr. Thompson was loaning his securities to Mr. Van Blarcom and I was loaning my securities to Mr. Van Blarcom, and in my absence and at the request of Mr. Van Blarcom, with the full knowledge of all the officers of the National Bank of Commerce, my son-in-law, Mr. Richards, joined in my name with Mr. Van Blarcom in guaranteeing the National Bank of Commerce the purchase of $1,545,000 Tennessee Central Railroad general mortgage bonds at the end of a year. Under just what circumstances I do not recollect now my guarantee with Mr. Van Blarcom was also given to the Mississippi Valley Trust Company for $600,000.

During the past many years Mr. Rich-

...publican Councilmen, Joseph M. Ebeling, Otto G. Koenig and Gustav J. Herrman.

Two of the suits are contests for seats in the House of Delegates from the First and the Seventeenth wards.

Attorneys Moses N. Sale, Jesse McDonald, Leo Meriwether and Glendy B. Arnold, for the Democrats, and Selden P. Spencer and George B. Webster, for the Republicans, will hold a conference soon to agree upon the plans for the general recount of the ballots of the entire city.

An order directing the Election Commissioners to open the ballot boxes in the Eighth Ward has been issued by Judge George C. Hitchcock of the Circuit Court.

It was issued on the application of Rudolph Schneider, defeated Republican candidate for the House, who has laid claim to the seat occupied by James F. Ford, Democrat.

BOND ELECTION IN FALL

Free Bridge Committee to Consider Building of Approaches Before Then.

There is little chance that the special free bridge bond election will be held before September. The Election Commissioners have informed Mayor Kiel that the election could not be held until July at least.

The Mayor is opposed to holding the election in midsummer, as many voters will be away on vacations, so the election probably will be postponed until after vacation time.

The Joint Free Bridge Committee of the Municipal Assembly will convene again Thursday afternoon to discuss the advisability of selecting an approach to the bridge before the election.

Roommate Found Dead in Bed.

Oscar P. Hoffman, 36 years old, a hatmaker, was found dead in bed Sunday by his roommate, George H. Parsons, at 3119 Olive street. The physician summoned said death was due to carbolic acid poisoning. An inquest will be held this morning.

Charles Dixon, 12 years old, adopted by the Bakers.

"The custody of the boy is sought by his Uncle George J. Dixon, who alleges the Bakers, who are Protestants, failed to raise the boy a Catholic, as they agreed. The case was brought here to reverse an order of Judge Bird that he be turned over to his uncle. The writ was made returnable in thirty days, when the matter will be heard on its merits.

The Court denied the writ of prohibition sought by Jean Lassance of Paris, France, to prevent Judge Hugo Grimm of the St. Louis Circuit Court from entertaining any further an appeal from a decision of the Probate Court of St. Louis in the final distribution of the estate of Peter Petz, deceased.

Lassance was one of the heirs to the estate and objected to this. The estate is inventoried at $23,719, and Lassance's share under the distribution and will is $1,310.

Following is a partial list of the motions disposed of and the other proceedings in the court in banc to-day:

Gold Issue Mining and Mineral Company, resp., vs. Pennsylvania Fire Insurance Company of Philadelphia., app.; respondent's motion to transfer to St. Louis Court of Appeals; appellant's suggestion in opposition to motion to transfer; motion overruled.

William P. Houston, resp., vs. Pulitzer Publishing Company, app.; appellant's motion to tax cost of printing abstract of record allowed for $81.

Floyd D. Jakson, plf., resp., vs. Edward Butler et al., def., app.; defendant appellant's motion to tax cost of printing abstract of record allowed for $94.50.

State ex rel. Tebbetts, rel., vs. Holtcamp, Judge; relator's motion to amend and affidavit in support; motion to amend sustained.

State ex rel. Circuit Attorney, rel., vs. Joseph A. Wright, resp.; respondent's motion to strike out certain statements from relator's reply; taken with case.

State ex rel. Joseph A. Wright, rel., vs. McQuillin, Judge, resp.; application of Eliza P. O'Hara for leave to file brief; leave granted.

State ex rel. Tebbetts vs. Holtcamp, J.; in the matter of Letitia Todd Breck vs. Rickarts et al.; argued and submitted together, with petitioner's reply to return of respondent filed in 17483.

MARRIAGE OF GIRL, 17, VOID

Foster Mother Refuses to Let Young Wife Live with Husband.

The marriage of Cora Berger, 17 years old, and Otto Berger, whom she was persuaded to marry when she was 15 years old, was annulled by Circuit Judge McQuillin yesterday.

A woman in whose bakery the girl was employed induced her to marry Berger, a baker at the place, she stated. The marriage took place at St. Charles. The woman for whom the girl worked accompanied her and Berger.

They returned to St. Louis immediately after the marriage and called at the home of the girl's foster mother, Mrs. Henry Duewel, of 3227 Hickory street. Mrs. Duewel would not let the girl live with Berger.

Robbed, Thrown from Eads Bridge.

Adam J. Dettling, who says he is an engineer of Bonne Terre, Mo., was found by Patrolman Brosnahan of the Carr Street Station on the levee last night, with his clothes dripping wet.

was instructed nearly two weeks ago to convey recognition to the new Republic as soon as those formalities had been complied with.

It is said at the State Department, however, that the failure of the Assembly up to this point to chose a Speaker, owing to sharply drawn party issues, is a sufficient obstacle to delay the execution of the instructions.

Notwithstanding the advantage that might be gained by an immediate recognition, it is believed here that the

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obtains.

Stock No. 6.

Balsam Fir.

Y INFERIOR;
TLE ARE WEAK

loderate, but Demand
nap—Native Beeves
ff 15c to 20c.

RECEIPTS.	
	2,000
	10,000
	3,000
nules	1,350

TTLE — Beef Steers—An or- arrived, and with quality Nothing toppy changed ous supplies of cattle at all al Western markets had a and buyers were out after a market lacked the support. of fair-quality steers went to y in the morning at $8.05@ was about the only steady in the market. Bulk of the nbracing only the fair to good ed hands in a range of $7.25 line amounted to about 10@ ow trade.

ND BUTCHER STEERS.

No.	Av.	Pr.	No.	Av.	Pr.
22..	1358	$8.25	38..	1173	$8.05
19..	1054	7.25	5..	716	7.15
8..	659	6.75	3..	620	6.50

rs and Bulls—Not an overly ly arrived and butcher cattle ly steady to strong. The heif- nothing to brag about, the ing the fair to good grades, steady. Slowness, however, e. Very few bunches choice d the best price was $8.25. from $7.35@8, those of lesser rom $6.75@7.25. earce and with a fairly good a goodly showing of choice uled from steady to strong. A as established and this figure several good-quality offerings. ged hands from $7 to the top. od kinds changed hands from ral near the cutter class sold . The supply of canners and ot generous and values held lls were generally steady bulk moving at $6@7.25.

HEIFERS.

No.	Av.	Pr.	No.	Av.	Pr.
13..	738	$8.00	8..	626	$7.60
12..	594	7.00	19..	815	7.25
1..	660	6.25	1..	580	6.00
1..	540	5.35	14..	232	4.75

COWS.

2..	1300	7.25	5..	1086	7.00
1..	1080	6.50	2..	1100	6.25
1..	680	5.75	1..	910	5.50
2..	660	4.75	1..	840	4.25
1..	650	3.75	2..	700	3.50

BULLS.

1..	910	5.25	2..	1179	7.00
1..	1320	6.90	2..	1125	6.90
2..	1285	6.75	3..	1104	6.50
2..	1450	5.85	1..	1340	5.00

Yearlings—A slim showing of as on hand. Choice kinds were prices showed little change. A was registered for the prime to good grades of veals sold 25, poorer classes and skim- at $8@9, fully steady. ere scarce, but one or two would have made good kills weights of quality changed $7.25@8; heavies, of fair to sold from $6.25@7.

ES AND YEARLINGS.

No.	Av.	Pr.	No.	Av.	Pr.
5..	122	10.25	2..	125	10.00
6..	108	9.25	5..	138	7.00
42..	447	7.25	1..	330	6.50
1..	190	5.50	13..	317	4.10

d Feeders—There was a fair uyers had comparatively easy stock steers sold. Bullocks dy. Choice feeders were scarce rom $7@7.55. Cows made up a rices ranging from $3.80@5.60,

$7.20@8.90; Texas steers $6.70@7.75; Western $6.90@8; stockers and feeders $6.10@8; cows and heifers $3.90@8.25; calves $6.25@9.25. Sheep—Receipts 25,000; weak to 15c lower; native $6@7.15; Western $6.25@7.15; yearlings $6.50@7.90; lambs, native $6.60@8.70; Western $7@8.75.

KANSAS CITY, Mo., April 28.—Cattle—Receipts 8,400, including 700 Southerns; 10c to 20c lower; dressed beef and export steers $7.90@8.50; fair to good $7@7.85; Western steers $6.75@8.25; stockers and feeders $6.50@7.90; Southern steers $6.25@8; Southern cows $4.25@7; native cows $4.25@7.35; native heifers $6.75@8.25;2 bulls $5.75@7.25; calves $6@9.50. Hogs—Receipts 10,000; 15c to 25c lower; bulk $8.25@8.45; heavy $8.25@8.40; packers and butchers $8.20@8.55; light $8.35@8.60; pigs $7.25@8. Sheep—Receipts 12,000; steady to 10c lower; lambs $7.50@8.60; yearlings $6.25@ wethers $5.50@6.75; ewes $5@6.50; stockers and feeders $4@5.50.

Stock No. 6.

ST. JOSEPH, Mo., April 28.—Cattle—Receipts 1,500; slow; steers $7.25@8.75; cows and heifers $4.25@8.50; calves $5.50@8.75. Hogs—Receipts 5,500; 15@20c lower; top $8.50; bulk $8.30@8.40. Sheep—Receipts 7,000; lower; lambs $7.50@8.65.

Balsam Fir.

SOUTH OMAHA, Neb., April 28.— Receipts 4,400; lower; native steers $7.50@8.60; cows and heifers $6@8; Western steers $6.75@8.25; Texas steers $6@7.65; cows and heifers $5.75@7.50; calves $7.75@9.75. Hogs—Receipts 6,700; lower; heavy $8.20@8.35; light $8.30@8.40; pigs $7.40@8; bulk $8.25@8.35. Sheep—Receipts 12,000; steady; yearlings .75; wethers $6.40@7; lambs $8.25@8.90.

Miscellaneous Markets.

GRASS SEEDS (Per 100 Lbs.)—Dull and unchanged; some demand for millet and good timothy, but no call for clover. Prices easy or nominal; offerings next to nothing. Quote: Millet—Trashy, mixed, etc., 70c to $1; bright, clean, sound at $1.25@1.40—prime German at $1.45 to $1.50; Hungarian at $1.15@1.30; timothy at $1@2 for tailings to $2.25@2.50 for trashy, $2.90@3 for fair and $3.20@3.35 for prime; clover at from $5@10 for weedy to $15 for the best good average run; redtop at $8@9 for recleaned seed—inferior grades, trashy, etc., less. No offerings worthy of mention on regular market; order business only fair.

STOCK PEAS—Quotable per bu. at from $1.50 to $1.80.

SORGHUM-CANE SEED—Quotable at 90c to $1.15 per 100 lbs., according to quality.

SUNFLOWER SEED—Quotable at $2.75@3.50 per 100 lbs.

ONION SETS—Bottoms quotable at $1.40 per bu. for red and yellow and $2 for white —sprouted less—orders higher.

DRIED FRUIT—Little or none offering; prices nominal; sun-dried quarters apples at 2@2½c; evaporated rings apples at from 3c for ordinary to 4c for choice; sun-dried peaches at 5c to 5½c; cores and peelings apples ½@¾c.

BEANS AND PEAS—Quote, on orders: White beans—Choice hand-picked at $2.40; prime at $2.30; screened at $2.10@2.15—inferior and artificially dried $2.05@2.10; black-eye $2@2.15 for Southern to $2.80@2.90 for California; Scotch peas at $1.75 per bu.; split peas at $2.70 per bu. for yellow and $3.25 for green; pink beans 5¼c per lb.; lima beans 6½c; lentils 5c; red kidney 4¾c.

CASTOR BEANS—Nominal at $1.50 per bu.

HONEY—Quote Southern extracted and strained—Bright amber in bbls. 6c per lb.; in cans 6½@7c; dark ½@1c per lb. less. Comb—Amber 14c; dark and inferior 9@11c per lb.; broken and leaking 7@8c; fancy clover 15@16c; very dull.

SORGHUM—Prime quotable at 40c per gal.

SALT—Quote: Granulated at $1.10 per bbl. and medium $1.15 tr. this side.

ROOTS—Quote golden seal $3.35; lady slipper 14c; Seneca 36@38c; pink 20c; black 7c—damp, dirty less; May apple 4c; snake 24@26c—stemmy and leafy less; Kansas black snake (Echinacea) 10c—split root half price; Oklahoma black snake 9c—Missouri worthless; Angelica 5c; wahoo bark of root 20c—bark of tree 5c; blood 4½c; blue-flag 2½c; sassafras bark of root 5c; wild ginger 6c; spikenard 3c; scullcap leaves—bright 9c, but dark less; wild ginseng $6.25@6.50; cultivated do. $1@2.50.

BROOM CORN—Firm. Good demand for all grades at the following prices: Quote per ton, at first hands, on trk.: Dwarf—Fair $50@55; medium $65@75; bright green hurl $85@90; standard brush—fair $65@75; medium $80@90; choice at $90@100; common, crooked, damaged, discolored, etc., less.

POP CORN—On cob, per 100 lbs., at from $1 to $1.60—latter for choice rice; inferior less.

NUTS—Quote: Pecans at 7c to 8c per lb. Peanuts 3@3½c per lb. for farmers' stock.

MOSS—Quote, per lb.; Gray mixed 1½@1¾c; gray, brown and black mixed 1¾@2c; brown and black mixed 2@2½c; machine-picked—xx 3@4½c; xxx 4@4½c; xxxx 5@5½c—inferior less.

RUBBER BAGS, ETC.—Country rags 80c per 100 lbs.; old rope, manila $1.50; common 40c. Rubber—No. $8; arctics—trimmed

DEALINGS IN N
FEATURE (

New Low Ground Is M
General Selling an
able Report

NEW YORK, April 28.- in the cotton market to regularity of May notices about 80,000 bales.

It was reported that hou erpol connections and lo ple were taking up the co was a good demand for M early trading, but no ag port developed and the new low ground in the la der renewed general sel vorable new crop or wea

The market opened 6 p 2 points higher, sold 4 to higher, and closed stead vance of 7 points on Apr ally 6 to 13 points unde figures of Saturday.

New York Cotton Quo

Reported by Francis, Bro. & Fourth street.

Month.	Open.	High.	Lo
Jan.	11.08	11.14	10.99
Mar.	11.13	11.13	11.03
May	11.26	11.44	11.22
July	11.40	11.53	11.32
Aug.	11.27	11.38	11.20
Sept.	11.17	11.17	11.05
Oct.	11.11	11.16	10.98
Dec.	11.13	11.19	11.00
Spot	11.70	....	.....

St. Louis Cotton M

Tone of market dull; uncha bales.

Ordinary ....

Good ordinary................

Low middling.................

Middling ....

Good middling................

Middling fair................

Tinges, ¼c to 1c off from v

Receipts at principal points

Galveston, 2,909 bales, ag year.

New Orleans, 1,097 bales, last year.

Mobile, 1,317 bales, against

Savannah, 1,933 bales, ag year.

Charleston, 381 bales, again

Houston, 3,550 bales, aga year.

Memphis, 606 bales, against

Net receipts at all United S three days were 18,226 bales bales last week and 28,535 bal ported 76,015 bales, against Stock 605,614 bales, against 6

Total receipts from Sept. 1 9,019,799 bales, against 11,3 the corresponding period the

Local warehouse statement:

T

Stock on hand Sept. 1......

Net receipts since Sept. 1....

Net receipts yesterday.......

Net shipments since Sept. 1.

Net shipments yesterday....

Stock on hand..............

Gross receipts yesterday.....

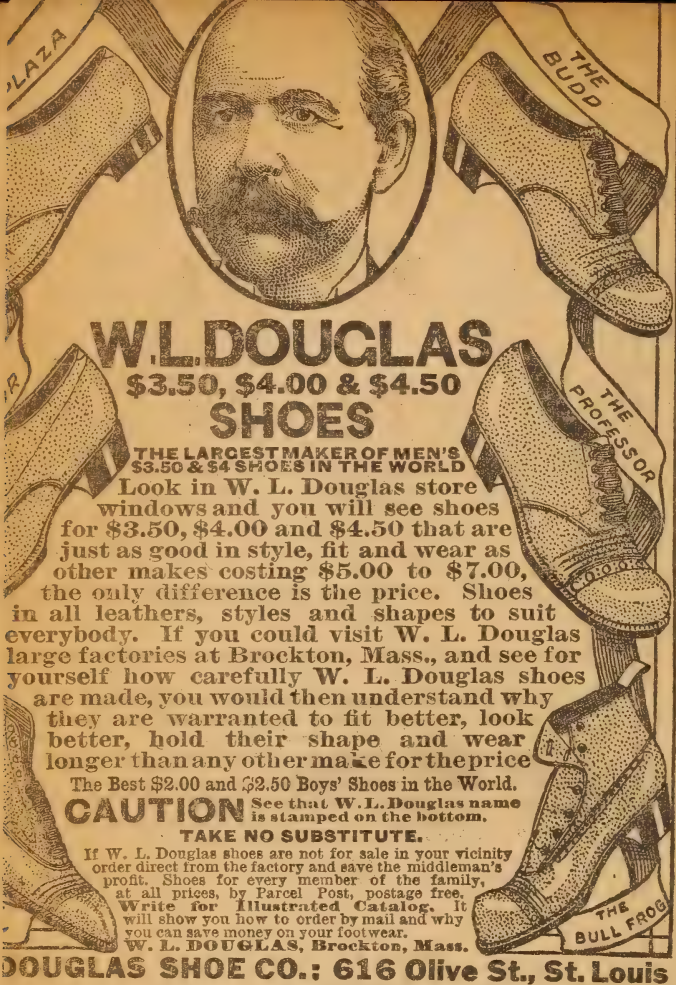
Gross receipts since Sept. 1..

Gross shipments yesterday...

Gross shipm'ts since Sept. 1.

Cotton at Liverp

LIVERPOOL, England, A —Spot in fair demand; pric dling fair 7.23c; good middl dling 6.70c; low middling 6. nary 6.20c; ordinary 5.86c; cluding 500 for speculation 7,700 American. Receipts 5, can. Futures opened stea



THREE PLUN
SCAFFOLD,

Two Others, Wor Get Fractured Broken L

VICTIMS CARRIED

Workmen Fall Thi and Cries Bring to Their

One man was injured and two others seriou scaffold on which the t ing at the William Gr pany, Second and Rutg way yesterday afterno feet.

Joseph Ferris, who h but a short while, an was unknown to his fe unconscious at the City fractured skull and int

James Dixon, 33 ye Shenandoah avenue, broken, and the left leg 22, of 3820 Page boulev in two places. The taken to St. Mary's In

The three men were scaffold inside a big st they were building.

Enos Konoskia, the their cries, but could until the other men, tion, brought ladders a inside the tank. They up a line of men form der.

CAN'T QUIT SUF

High State Court Re Request to Quit M

JEFFERSON CITY, The Supreme Court in fused the application o D. Shewalter of Indepe his name withdrawn a the bar of the court.

Why Judge Shewalter his name stricken fro why the court refused quest does not appear i the day's proceedings, entry of the request an

When the habeas cor R. Nelson of Kansas brought to the court s

Stock No. 10.

Balsam Fir.

...LITY INFERIOR; ...CATTLE ARE WEAK

...pts Moderate, but Demand ...cks Snap—Native Beeves Off 15c to 20c.

RECEIPTS.

....	2,000
....	10,000
....	3,000
... and mules....................	1,350

...VE CATTLE — Beef Steers—An or- ...showing arrived, and with quality ...medium. Nothing toppy changed ... Generous supplies of cattle at all ... principal Western markets had a ... effect and buyers were out after a ...t. The market lacked the support. ...unches of fair-quality steers went to ...ers early in the morning at $8.05@ ...d this was about the only steady ...gistered in the market. Bulk of the ...pply, embracing only the fair to good ... changed hands in a range of $7.25 ...he decline amounted to about 10@ ...th a slow trade.

...EEF AND BUTCHER STEERS.

...	Pr.	No.	Av.	Pr.	No.	Av.	Pr.
...1	$8.35	22..	1358	$8.25	38..	1173	$8.05
...1	8.00	19..	1054	7.25	5..	716	7.15
...0	7.00	8..	659	6.75	3..	620	6.50
...10	6.00						

Heifers and Bulls—Not an overly ...is supply arrived and butcher cattle ...rom fully steady to strong. The heif- ...ply was nothing to brag about, the ...onstituting the fair to good grades, ...ld fully steady. Slowness, however, ...ticeable. Very few bunches choice ... up and the best price was $8.25. ...eared from $7.35@8, those of lesser ... sold from $6.75@7.25. ... were scarce and with a fairly good ... and a goodly showing of choice ...alues ruled from steady to strong. A ...$7.50 was established and this figure ...ld for several good-quality offerings. ...t changed hands from $7 to the top. ...n to good kinds changed hands from ...7. Several near the cutter class sold ...than $6. The supply of canners and ... was not generous and values held ...wn. Bulls were generally steady bulk ...supply moving at $6@7.25.

HEIFERS.

...	Pr.	No.	Av.	Pr.	No.	Av.	Pr.
...6	$8.25	13..	738	$8.00	8..	626	$7.60
...9	7.50	12..	594	7.00	19..	815	7.25
...8	6.50	1..	660	6.25	1..	580	6.00
...7	5.75	1..	540	5.35	14..	232	4.75
...0	4.25						

COWS.

...0	7.50	2..	1300	7.25	5..	1086	7.00
...5	6.65	1..	1080	6.50	2..	1100	6.25
...0	6.00	1..	680	5..	1..	...	...
...3	5.25	2..	660	4.75	1..	840	4.2...
...0	4.00	1..	650	3.75	2..	700	3.50

BULLS.

...0	7.25	1..	910	5.25	2..	1179	7.00
...0	7.00	1..	1320	6.90	2..	1125	6.90
...0	6.75	2..	1285	6.75	3..	1104	6.50
...0	6.50	2..	1450	5.85	1..	1340	5.00

...s and Yearlings—A slim showing of ...alers was on hand. Choice kinds were ..., but prices showed little change. A ...$10.50 was registered for the prime ... Fair to good grades of veals sold ...9@10.25, poorer classes and skim- ...earing at $8@9, fully steady. ...ings were scarce, but one or two ... that would have made good kills ...Medium weights of quality changed ... from $7.25@8; heavies, of fair to ...rade, sold from $6.25@7.

CALVES AND YEARLINGS.

...	Pr.	No.	Av.	Pr.	No.	Av.	Pr.
...5	10.50	5..	122	10.25	2..	125	10.00
...4	9.50	6..	108	9.25	5..	138	7.00
...0	9.00	42..	447	7.25	1..	330	6.50
...0	6.00	1..	190	5.50	13..	317	4.10

...ers and Feeders—There was a fair ... and buyers had comparatively easy ... Few stock steers sold. Bullocks ...ly steady. Choice feeders were scarce ...ared from $7@7.55. Cows made up a

$7.20@8.90; Texas steers $6.70@7.75; Western $6.90@8; stockers and feeders $6.10@8; cows and heifers $3.90@8.25; calves $6.25@9.25. Sheep—Receipts 25,000; weak to 15c lower; native $6@7.15; Western $6.25@7.15; yearlings $6.50@7.90; lambs, native $6.60@8.70; Western $7@8.75.

KANSAS CITY, Mo., April 28.—Cattle—Receipts 8,400, including 700 Southerns; 10c to 20c lower; dressed beef and export steers $7.90@8.50; fair to good $7@7.85; Western steers $6.75@8.25; stockers and feeders $6.50@7.90; Southern steers $6.25@8; Southern cows $4.25@7; native cows $4.25@7.35; native heifers $6.75@8.25;2 bulls $5.75@7.25; calves $6@9.50. Hogs—Receipts 10,000; 15c to 25c lower; bulk $8.25@8.45; heavy $8.25@8.40; packers and butchers $8.20@8.55; light $8.35@8.60; pigs $7.25@8. Sheep—Receipts 12,000; steady to 10c lower; Colorado lambs $7.50@8.60; yearlings $6.25@7.05; wethers $5.50@6.75; ewes $5@6.50; stockers and feeders $4@5.50.

ST. JOSEPH, Mo., April 28.—Cattle—Receipts 1,500; slow; steers $7.25@8.75; cows and heifers $4.25@8.50; calves $5.50@8.75. Hogs—Receipts 5,500; 15@20c lower; top $8.50; bulk $8.30@8.40. Sheep—Receipts 7,000; lower; lambs $7.50@8.65.

SOUTH OMAHA, Neb., April 28.—Cattle—Receipts 4,400; lower; native steers $7.50@8.60; cows and heifers $6@8; Western steers $6.75@8.25; Texas steers $6@7.65; cows and heifers $5.75@7.50; calves $7.75@9.75. Hogs—Receipts 6,700; lower; heavy $8.20@8.35; light $8.30@8.40; pigs $7.40@8; bulk $8.25@8.35. Sheep—Receipts 12,000; steady; yearlings ... 75; wethers $6.40@7; lambs $8.25@8.90.

Miscellaneous Markets.

GRASS SEEDS (Per 100 Lbs.)—Dull and unchanged; some demand for millet and good timothy, but no call for clover. Prices easy or nominal; offerings next to nothing. Quote: Millet—Trasny, mixed, etc., 70c to $1; bright, clean, sound at $1.25@1.40—prime German at $1.45 to $1.50; Hungarian at $1.15@1.30; timothy at $1@2 for tailings to $2.25@2.50 for trashy, $2.90@3 for fair and $3.20@3.35 for prime; clover at from $5@10 for weedy to $15 for the best good average run; redtop at $8@9 for recleaned seed—inferior grades, trasny, etc., less. No offerings worthy of mention on regular market; order business only fair.

STOCK PEAS—Quotable per bu. at from $1.50 to $1.80.

SORGHUM-CANE SEED—Quotable at 90c to $1.15 per 100 lbs., according to quality.

SUNFLOWER SEED—Quotable at $2.75@8.50 per 100 lbs.

ONION SETS—Bottoms quotable at $1.40 per bu. for red and yellow and $2 for white—sprouted less—orders higher.

DRIED FRUIT—Little or none offering; prices nominal; sun-dried quarters apples at 2@2½c; evaporated rings apples at from 3c for ordinary to 4c for choice; sun-dried peaches at 5c to 5½c; cores and peelings apples ½@¾c.

BEANS AND PEAS—Quote, on orders: White beans—Choice hand-picked at $2.40; prime at $2.30; screened at $2.10@2.15—inferior and artificially dried $2.05@2.10; black-eye $2@2.15 for Southern to $2.80@2.90 for California; Scotch peas at $1.75 per bu.; split peas at $2.70 per bu. for yellow and $3.25 for green; pink beans 5¼c per lb.; lima beans 6½c; lentils 5c; red kidney 4¾c.

CASTOR BEANS—Nominal at $1.50 per bu.

HONEY—Quote Southern extracted and strained—Bright amber in bbls. 6c per lb.; in cans 6½@7c; dark ½@1c per lb. less. Comb—Amber 14c; dark and inferior 9@11c per lb.; broken and leaking 7@8c; fancy clover 15@16c; very dull.

SORGHUM—Prime quotable at 40c per gal.

SALT—Quote: Granulated at $1.10 per bbl. ...medium $1.15 tr. this side.

Balsam Fir.

...OTS—Quote golden seal $3.35; lady slipper 14c; Seneca 36@38c; pink 20c; black 7c—damp, dirty less; May apple 4c; snake 24@26c—stemmy and leafy less; Kansas black snake (Echinacea) 10c—split root half price; Oklahoma black snake 9c—Missouri worthless; Angelica 5c; wahoo bark of root 20c—bark of tree 5c; blood 4½c; blue-flag 2½c; sassafras bark of root 5c; wild ...c; spikenard 3c; scullcap leaves—... but dark less; wild ginseng $6.25@6.50; cultivated do. $1@2.50.

Stock No. 10.

BROOM CORN—Firm. Good demand for all grades at the following prices: Quote per ton, at first hands, on trk.: Dwarf—Fair $50@55; medium $65@75; bright green hurl $85@90; standard brush—fair $65@75; medium $80@90; choice at $90@100; common, crooked, damaged, discolored, etc., less.

POP CORN—On cob, per 100 lbs., at from $1 to $1.60—latter for choice rice; inferior less.

NUTS—Quote: Pecans at 7c to 8c per lb. Peanuts 3@3½c per lb. for farmers' stock.

MOSS—Quote, per lb.: Gray mixed 1½@1¾c; gray, brown and black mixed 1¾@2c; brown and black mixed 2@2½c; machine-picked—xx 3@4½c; xxx 4@4½c; xxxx 5@5½c—inferior less.

RUBBER BAGS, ETC.—Country rags 80c per 100 lbs.; old rope, manila $1.50; ...

DEALINGS I... FEATU...

New Low Ground... General Sellin... able Re...

NEW YORK, April ... in the cotton mark... regularity of May n... about 80,000 bales. ...

It was reported tha... erpol connections ar... ple were taking up t... was a good demand ... early trading, but ... port developed and ... new low ground in t... der renewed genera... vorable new crop or...

The market opened ... 2 points higher, sold ... higher, and closed ... vance of 7 points on ... ally 6 to 13 points ... figures of Saturday.

New York Cotto...

Reported by Francis, ... Fourth street.

Month.	Open.	High...
Jan.	11.08	11.14
Mar.	11.13	11.18
May	11.26	11.44
July	11.40	11.53
Aug.	11.27	11.38
Sept.	11.17	11.17
Oct.	11.11	11.16
Dec.	11.13	11.19
Spot	11.70	......

St. Louis Cot...

Tone of market dull; ... bales.

Ordinary ....
Good ordinary.........
Low middling..........
Middling ....
Good middling.........
Middling fair.........

Tinges, ¼c to 1c off; ...

Receipts at principal ...

Galveston, 2,909 bale... year.

New Orleans, 1,097 ... last year.

Mobile, 1,317 bales, a... Savannah, 1,933 bale... year.

Charleston, 381 bales, ... Houston, 3,550 bales ... year.

Memphis, 606 bales, a...

Net receipts at all U... three days were 18,226 ... bales last week and 28,... ported 76,015 bales, a... Stock 605,614 bales, aga...

Total receipts from ... 9,019,799 bales, agains... the corresponding peri...

Local warehouse state...

Stock on hand Sept. 1, ...
Net receipts since Sept. ...
Net receipts yesterday, ...
Net shipments since Se...
Net shipments yesterd...
Stock on hand.........
Gross receipts yesterda...
Gross receipts since Se...
Gross shipments yester...
Gross shipm'ts since Se...

Cotton at ...

LIVERPOOL, Englan...—Spot in fair demand ... dling fair 7.23c; good ... dling 6.70c; low middl... nary 6.20c; ordinary ... cluding 500 for specula... 7,700 American. Recei...

THREE PLUNGE W SCAFFOLD, 1 D

Two Others, Working i Get Fractured Ribs Broken Leg.

VICTIMS CARRIED UP LA

Workmen Fall Thirty Fe and Cries Bring Fore to Their Aid.

One man was injured probab and two others seriously hur scaffold on which the three we ing at the William Graver Ta pany, Second and Rutger stre way yesterday afternoon. Th feet.

Joseph Ferris, who had been but a short while, and whose was unknown to his fellow la unconscious at the City Hospit fractured skull and internal i

James Dixon, 33 years old, Shenandoah avenue, had th broken, and the left leg of Jan 22, of 3820 Page boulevard, wa in two places. The two lat taken to St. Mary's Infirmary

The three men were at wor scaffold inside a big steel tan they were building.

Enos Konoskia, the forema their cries, but could not rea until the other men, under h tion, brought ladders and lowe inside the tank. They were th up a line of men formed on e der.

39 DIVORCES ARE GR

Seven New Suits for Marital Are Filed.

Divorces granted yesterda Dudley F. from Mary M. Will B. from Frank J. Swatek, Joh Annie Mallon, Emma from W Patchin, Mary N. from Thomas Eva A. L. from Robert Bisho beth from Peter McNally, from Orlando Gardner, Ma Thomas Smith, Lulu from F Buesing, Carrie from Levi Key from W. E. Long, Alma fro Raymond, Mary D. from John weth, Minnie from George V

Stock No. 7.

Lodgepole Pine. --- California.

HER REPORT

recast by States.
N, D. C., April 28.—Forecast:
· and warmer Tuesday.
obably fair.
ir and warmer Tuesday.
bably fair: moderate, varia-
enerally fair Tuesday and
Fair Tuesday and Wednes-
outh winds.
Fair Tuesday and Wednes-
Nebraska—Fair Tuesday and
esday; not quite so warm
r Tuesday and Wednesday;
d warmer Tuesday. Wednes-
Tuesday and Wednesday;
ature; moderate, varia-
ir Tuesday and Wednesday;
ire.
aken at 8 p. m., seventy-
ime.

Dr.	Tp.	Mx.	Prec.	Weather.
...N	62	64	....	Clear
...S	78	82	....	Clear
..SE	52	58	.22	Cloudy
..W	54	62	.20	Clear
a..N	56	58	.06	Cloudy
...W	50	52	....	Cloudy
...N	50	50	.42	Cloudy
..NE	54	56	.28	Rain
...N	60	64	....	Clear
..NE	36	40	....	Cloudy
..W	58	66	....	Clear
.NW	50	54	....	Cloudy
...S	66	72	....	Pt cloudy
...N	46	48	....	Clear
.NW	46	46	.26	Rain
...N	44	46	.70	Cloudy
..SE	68	72	....	Clear
..SE	70	74	....	Clear
.NE	62	66	....	Clear
...N	44	44	.34	Cloudy
NW	74	80	....	Pt cloudy
..SE	64	68	....	Clear
.. N	48	48	.12	Clear
D.S	70	74	....	Clear
..SE	72	78	....	Clear
.NE	62	64	....	Clear
.NE	42	48	....	Clear
...S	68	70	....	Pt cloudy
NW	32	34	.02	Cloudy
.SW	82	84	....	Clear
.SW	48	52	.10	Clear
NE	52	54	....	Cloudy
SW	58	64	....	Clear
...E	68	70	....	Clear
SW	84	88	....	Clear
NW	70	70	....	Clear
.SW	68	74	....	Clear
NW	42	52	.02	Cloudy
...S	68	72	....	Clear
..N	52	52	.12	Pt cloudy
NW	64	70	.04	Clear
...E	62	66	....	Clear
..N	62	66	....	Clear
..SE	64	68	....	Clear
SW	60	68	....	Clear
..W	46	46	.08	Cloudy
NW	64	64	....	Clear
.SW	72	80	....	Clear
NW	66	70	....	Clear
..N	60	64	.01	Cloudy
NW	50	52	....	Cloudy
..N	70	74	....	Clear
.SE	54	64	1.08	Clear
..W	50	56	....	Cloudy
...S	54	66	.01	Rain
h.E	56	58	....	Clear
...S	78	84	....	Clear
.SE	64	68	....	Clear
.E	58	62	1.72	Cloudy
W	86	90	....	Clear
NW	46	46	.82	Rain
NW	52	54	.04	Cloudy
SW	78	82	....	Clear
NW	54	56	.12	Clear
...S	80	82	....	Cloudy
.SE	62	64	....	Cloudy
SW	52	56	....	Clear
..E	64	68	....	Clear
.SE	64	68	....	Clear
...S	72	74	....	Clear
...S	80	84	....	Clear
..W	62	66	....	Clear
.W	54	56	....	Clear
.SW	64	68	....	Clear
.W	44	56	....	Clear
.NE	62	72	....	Clear
.NE	70	74	....	Clear
...S	64	66	....	Clear
SE	48	50	....	Cloudy
..N	60	64	....	Clear
NE	62	66	....	Clear
NW	54	62	....	Cloudy
.SE	70	74	....	Clear
..N	66	70	....	Pt cloudy
.SE	62	68	....	Clear

KIEL MEETS B. P. I. ON BOAT

Mayor Makes Trip to Chesley Island on Erastus Wells.

The harborboat Erastus Wells, the vessel on which former Mayor Kreismann and his "cabinet" of advisers met and discussed city affairs almost weekly last summer, was the scene yesterday of a similar conference between Mayor Kiel and members of the Board of Public Improvements.

The main object of the trip was an inspection of Chesley Island, one of the sites suggested for a municipal garbage-reducton plant.

Accompanying the party was J. T.

PROTESTANTS FORM

Joint Commission of Two Adopts Merger Pl

COLUMBUS, O., April 28.- commission of the Protest and the United Brethren in session here to-day, u adopted a basis of union churches, forming a new de to be known as the United Church.

The report of the commissi be ratified by the general of their respective churches

he graduates: Misses Mattie Con-
.. Wright, Letha E. Hard, Nellie
ssrs. George Wilton, William G.
: Ryan and Russell Carter.

. LOUIS COUNTY.

rood Business Men Banquet.

·wood Business Men's Association rd annual banquet last night at in Maplewood. Addresses were rosecuting Attorney Lashly and re G. A. Wurdeman.

ELEGATES IN SESSION

Meeting Refers Free Bridge to Various Organizations.

elegates representing fifteen unizations attended the reg- thly meeting of the Central ncil at the Public Library ast night.

Gundlach spoke in favor of o buy ground for more parks ng the cost assessed against rty that was benefited by blishment.

Winn, superintendent of the Lodging-House, told of the omplished by that institution ed the establishing of a larger a central part of the city.

egates approved the bill for vement of the street car serv- pposed the repeal of the Pub- ce Commission. The Free ngle was referred to the vari- iizations.

ls providing for the ventila- treet cars, for the wrapping and for the disposal of ashes, ling, were approved.

AS AUTO RACERS HELD

uick Causes Arrest of Two in White Slave Case.

GELES, Cal., April 28.—Delv- r into the white slave bands ngeles the police to-day ar- illiam Le Casse and Richard orth, automobile racing driv- harges preferred by Evelyn 15-year-old schoolgirl.

se was arrested in the apart- a former society woman, isband is now suing for di- Hollingsworth tried to evade barricading himself in his t the police tore down the

ald Asked to Succeed Dunn.

me of Capt. William J. Mac- r the office of Supervising In- f Steamboats in the St. Louis to succeed Joseph J. Dunn, a few weeks ago, was sent enate last week. Capt. Mac- as been United States Inspector boat Boilers in this district years. The promotion will vacancy in the office of Inspec- Boilers. This will be filled by nent from the civil-service list ansfer form another district.

Heads Banking Institute.

annual election of the St. Louis of the American Institute of last night the following offi-

Belleville, blew yesterday morning 200 men walked out of the shop on a strike because the company has failed to employ union men in the polishing room.

MARQUETTE RECEIVER ASKED

Court Is Petitioned to Remove Officers of Downtown Hotel.

Arthur Thacher applied to the Circuit Court yesterday for a receiver for the Glancy & Watson Hotel Company, which conducts the Marquette Hotel, at Eighteenth street and Washington avenue.

The company is capitalized for $100,000. Thacher owns ten shares of the stock and T. H. Glancy, president and manager, owns 750 of the 1,000 shares.

The company was organized in February, 1907, with Glancy and M. D. Watson managers at salaries of $3,600 a year, it is stated. Glancy bought Watson's interest in August, 1910, and has been drawing $600 a month salary, it is asserted.

The court is asked to remove Glancy and the Board of Directors and require an accounting.

Engineers Discuss St. Louis Chapter.

Charles F. Rand and Bradley Stoughton, president and secretary, respectively, of the American Institute of Mining Engineers, were entertained at a dinner at the St. Louis Club last night by Missouri and Illinois members of the association. The advisability of organizing a local chapter of the institute as a "get-together proposition" for Missouri and Illinois engineers was discussed. Both Mr. Rand and Mr. Stoughton addressed the diners, while other speakers were former Gov. D. R. Francis, H. A. Buehler, State Geologist, of Rolla, Mo., and Capt. R. W. Hunt of Chicago.

Poultry.

NEW YORK, April 28.—Live Poultry—To-day is the Hebrew Last Passover, and with the buyers absent, there was no business and no poultry was unploaded. Some 9 cars arived on trk., but will not be unloaded till to-morrow.

Dressed Poultry—Receipts 1,488 pkgs. Very little fresh-killed poultry here of any description, a few lots of fowls went at 18⅓@19c, but large fowls are difficult to strain up to 18½c. Old roosters scarce and firm. Squabs a trifle easier and only fancy exceeding $4 on an 8-lb. average. There were a few lots of frozen fowls thrown on the market and held up to 19c, but buyers are reluctant to pay that price, and very little business reported. Frozen roasters held with more confidence. Frozen turkeys active.

Fresh-Killed Poultry—Dry-packed turkeys, hens, av., 22@23c; toms, young, av., 22c; do. old 21c.

Fowls—Box-packed, 12 birds to box: Western dry-picked, 60 lbs., 19c; do., 48@55 lbs., 19c; do., 36@42 lbs., 17½@18½c; do., under 36 lbs., 16@16½c; do., bbls., over 5 lbs., 18½c; do., 4 lbs. each, 18½@19c; Western dry-picked, iced, 18⅓@19c; do., bbls., 3@3½ lbs. each, 17@18c; do., bbls., Southern and Southwestern, 17½@18½c; scalded, bbls., other Western, av., 17½@18⅓c.

Old Roosters—Dry-picked 14½c; do. scalded 14½c.

Squabs—White, fancy, 10 lbs. to doz., $5@5.50; do., 9 lbs. to doz., $4.50@4.75; do., 8 lbs. to doz., $4@4.25; do., 7 lbs. to doz., $3.25@3.50; do., small, 6@6½ lbs. to doz., $2.25@2.50; culls, per doz., 65@75c.

Guinea Fowls—Old, per pair, 85@90c; do. young, per pair, $1@1.15.

Frozen Poultry—Turkeys—Young toms, fancy, under 16 lbs. each, 25⅓c; do. over 17 lbs. each, 24½@25c; do. av., mixed sizes 23½@24c; do. Texas and small Western 22@23c; young hens, fancy, per lb., 23½@24c.

Fowls—Dry-picked, No. 1, 60 lbs. and over to doz., 19c; do., 45@55 lbs. to doz., 19c; do., 36@42 lbs. to doz., 18½c; do., under 36

keys 16c; small and poo cocks 10c; chickens 19c; 6c to 10c; ducks 13c; ca 17c.

PIGEONS AND SQ pigeons at 75c per doz. S ers (7@8 lbs. to the do large homers (9@10 lb some small sold at $3; and dead pigeons 60c pe

VEALS—Market firme few offered, but receipt arrive until about noon. for choice medium weigh lbs. 9c per lb.; do. 150 180 to 200 lbs. at 8c; rou tics of over 200 lbs., a under-weight, at 6@7c. bucks at 3@4c. Yearlin for fair to 6⅓@7½c for lambs—Choice fat, weigh at $4.50@ per head; s Sheared sheep sell at 1c than full-wooled.

ROASTING PIGS—Quo at $2@2.25; 25@30-lb. a

FRESH FISH—Quote dressed, 3½@4½c; do. dressed, large, 6c; do. 4½c; do. round 3c; su large, 11c; do. medium black bass, 2½ lbs. an @2½ lbs., 10c; do., ord 12c; spoonbill cat, 4@10 and over, 11c; do, less large, collar bones off, lar bones on, 9c; bullhe collar bone on, 6c; white do. round 2½c; grass pi shell turtle, dressed, 7c; meat 8½c; frogs, large, medium 75c; do. small

Hides. Furs.

FEATHERS—Prime w prime gray do. 44c; o 27@31c; xx 15@18c; x tare 10 per cent on s large. Duck—White 44 —Prime dry-picked bod quill-mixed 2c. Turke quill-mixed 18c.

BEESWAX—Quote p impure and inferior less

SHEEP PELTS—Quo $1 each for green or d spring lambs at 10c to kill. Dry 10c per lb. f sandy and heavy.

GOAT SKINS—Quote 5@15c.

WOOL—A few small arriving and selling on given herewith; marke and accurate prices no The trade awaiting a se question; besides shear Quote, nominal price 17c for low to 1 12c for heavy to 16 15@17c; burry 11@13 for slight; Souther burry to 17c for clear; to 16c, and fine 11c for medium 16@17c; do. h ern or Western 17c bright medium; 10c to for hard burry to 16c f 20c for burry to 28c fo 15c for burry to 25c fo for long lustrous.

TO GROWERS OF successfully with forei realize top market pric put the wool in prope tion. The wool must be it is sheared, and whe in fleeces with a light After all dung, skirts a ter practicable is remov separate from burry, fine, etc., and otherwis as possible for manufa

FURS—The season i as offerings are more prices are about two- ues. Current receipts coon 25c to $1, mink to 30c skunk (Central rat (do.) 40c to 45c, c cat 10@15c, gray fox @4; wolf 25c.

HIDES—Market ina ners buying only fo Green salted in light good many "shedders" ble. Dry quiet.

Wet Salted.

Round	13¼
No. 1	13¾
No. 2	12¾
Bull	10¼
Glue stock	8¼

Uncured or fresh 1½ cured ¾c per lb. less horse hides $3.50 each and pony $1.50@2; ho pigs half price.

London W

LONDON, April 28 demand for the vari

Stock No. 8.

Red Fir.

r and Delmar avenues, essor to Louis P. Aloe o the Republican City tee.

Carl Kimmel and Lee central figures in the be recently resigned as rom his ward after he the Board of Freehold-itical wrangle resulted ng his successor.

vice president of the s acting president, was r committeeman, and oe and Judge Kimmel g" John D. Gates, their the job.

at the opening of the was presided over by secretary of the club, ent had not authorized

ignored Orcutt. sident the constitution e suspended, and after ehr was chosen to the ns for committeeman Gates was the only

lk by Aloe, in which ers addressed to him which he announced didate to succeed Aloe nouncing him for un-es was elected by ac-

d fourteen of the sev-Committee elected ssor at a meeting a felt insulted, he said, of unfairness made by red he had done noth-hem.

sed and hooted when and a fight threatened olley of sarcastic re-at him, he shouted noise, Indians!" Sev-took exception to the ared it their right to ker.

ere hurriedly made e machine and no at-d to Orcutt when he floor.

ager to accept the orkers" and, as a re-thusiasm when "Mr. ced in nomination for elected before it was ch person was pres-ew him, the man who having meant a Mr. as present.

OWER CALIFORNIA

ists Propose to Annex Possession.

al., April 28.—Declar-00 has been pledged of Lower California n Government by a an capitalists, W. J. ge property owner at oss the bay from En-alifornia, announced he deal would be con-d that annexation by

...was told to-day to the Legislative Investigation Committee by a 16-year-old girl who identified herself as "Irene G."

Witness was 15 years old when she went to the home, to work for her keep, medical attention and her approaching accouchment.

"I was forced to scrub floors and lift heavy trunks the day my baby was born," she declared.

She said that an overworked doctor at the home had expressed to her the fear that he would be unable to perform properly the necessary obstetrical operations when her baby was born. This proved true, she said, for one eye of the infant was punctured by an instrument.

Witness was at home nine months she said, and she worked at scrubbing floors and waiting on table till she dropped from exhaustion. The food, she asserted, was scant and very bad, often unfit to eat.

Overwork and hardships impaired her health, she said. The girls had to attend chapel three times a day, and when they were ill they didn't feel like kneeling down and have visitors pray "at" them.

Marcia Berlyn Weinberg, who was dentist of the home for a year, testified she had criticised the practice of making girls scrub floors until the day their babies came into the world.

She asserted the head of the institution had once scored the girls in a sermon, declaring that they should "be forced to eat under the table, like dogs."

WAGE COMMISSION TO MEET.

Chairman Calls Members to Gathering in St. Louis May 15.

Michael J. Kinney, chairman of the special committee created by the Missouri Legislature at its last session to inquire into wages, working and living conditions in the State, yesterday issued a call to the committee to assemble in St. Louis May 15.

The investigation will be similar to that recently conducted by the Illinois Vice Commission.

The examination of witnesses will begin soon after May 15 and will include factory and department store owners and managers and attaches of all kinds of industrial plants where a large number of persons, especially girls, are employed.

The testimony will be submitted to the Legislature.

$200,000 FOR CANCER CURE

Henry Rutherfood Leaves Rockefeller Institute Special Bequest.

NEW YORK, April 28.—The Rockefeller Institute for Medical Research is left $200,000 by the will of Henry Rutherfood of Grand Isle, Vt., who died here. erfood of Grand Isle, Vt., who died here February 26.

The will was filed here to-day. The income of the bequest, the testator says, is to be used to find a cure for cancer.

pared a synopsis of the which that body will open rules were prepared and a after the commission cam istance, April 5, and soon of the hands of the printer for distribution.

The synopsis of the rules

Any public utility coming und diction of the commission ma copy of the new public-service copy of the rules of the commi quest; and also any attorney deliver a copy of either may on request to the commission.

Stock No. 8.

The rules, as adopted by the abolish all technicalities in proc that body. A plain statement complaint is required to be ma by the complainant. Complan amended at any time in the d the commission.

Red Fir.

The commission will hold regu ly sessions at its office in Jeffer first Tuesday in each month, co o'clock in the morning. Under t the rules, the commission is op ously for the transaction of busi every day of the week except S legal holidays. Other sessions o mission will be held in Jefferso elsewhere as the business requir

No rate of any public utility can be increased after April 15 law became effective, without t notice and consent of the commis

One of the strongest features c is the supervision to be exercise issuance of stocks, bonds and no lic-service corporations of the S

In additon to scrutinizing ca purpose for which such bonds, notes are to be issued, the comm require an itemized statement o penditure of such moneys, verifi of some officer of the public-ser ration, to be filed with the commi end of each six months, showing position has been made of the p the sales of such stocks, bonds a

In this way the commission fee moneys and obl'gations of pu corporations on which the public a return in rates should be inv estly and expended properly for est of the public, as well as the utility.

The rules set out in full forms plaints, applications and other p before the commission, which will terest to lawyers practicing before mission, and also to all utilities ulation of the commission.

Under the rules, when a compla ceived an order of the commissio that the party complained agai satisfy the complaint or answer ten days thereafter; also a copy complaint is sent the party c against.

If at the end of ten days the is not satisfied, then the commiss an order for a public hearing, g party complained against ten da of such time and place.

In this way it is hoped the bu the commission will be expedite long drawn-out litigation.

Welfare Delegates Appoin

JEFFERSON CITY, Mo., Ap State Superintendent W. P. E day appointed as delegates to enteenth Child Welfare Natio gress of Mothers and Parent Associations, which will meet ton, Mass., May 15—20, Miss Griffith, St. Louis; Miss Estelle Springfield, and Miss Ella V. I Columbia.

throughout the col-

rmosa Panamas—
98 and up.

ew Styles in
Summer Hats

els in Panama, Leg-
ats are shown in this
ew and clever styles
delight the little ones.
ery moderate.

OR AND WIFE TO SHOP

get Affairs of State and Visit Downtown Stores.

Mrs. Major will go shopping
or the brief space that lies
early shopping hours and
ge in the big stores, the Gov-
forget all about politics, ap-
s, insurance tangles and
gresses, while he aids Mrs.
ke purchases for the Exe-
nsion.

sday I will be astride a horse
time," said the Governor late
t, "and a strenuous day of
will sort of prepare me for
als. Thursday I am to appear
e Peace Congress, so, alto-
will be busy enough while in
."

vernor is still considering his
ents for the Public Utilities
on.

a number of men in mind,"
"but I have made no decision."
sed to comment on the avail-
of J. E. Allison for the fifth
that body, who is said to be
he many applicants for the

nd Mrs Major will be the
Mr. and Mrs. Fred D. Gardner

PANKHURST JEERED

Freedom Continues, Disappointing London Crowd.

ON, April 28.—The expiration of
ted license under which Mrs.
e Pankhurst, the militant suf-
leader, was released April 12,
olloway Jail, where she was
three years' imprisonment,
a great crowd to assemble to-
the house where she has been
to recover from the effects of
nger strike.

eople's expectation of seeing her
returned to jail was disap-
the authorities having in the
decided to extend her license
o her unsatisfactory health.

Mrs. Pankhurst's feminine
r started off from the house
ss Sylvia Pankhurst, during the
on, a hooting crowd tried to
e car.

Miner's Dog Dies of Grief.

women's conference declared in favor of the minimum wage bill, initiative and referendum, and the limited suffrage bill.

The women's conference and a meeting of the State Central Committee were the only meetings scheduled for this morning.

B. F. Harris of Champaign tendered his resignation as chairman of the State Committee, resigning on account of ill health. John F. Bass of Chicago was elected to succeed him. Fred S. Willbur of East St. Louis was elected to succeed Mr. Bass as vice chairman.

H. L. Fordham of Dixon, who has been acting treasurer of the committee, was elected treasurer.

Joel F. Longnecker of Chicago was elected member of the committee for the First District, to succeed Chauncey Dewey, who resigned some time ago.

TRIES TO "DUCK" HAYWOOD

Crowd Threatens Labor Leader When He Is Arrested in Passaic.

PATERSON, N. J., April 28.—William D. Haywood, leader of the Industrial Workers of the World, was arrested at Passaic to-day on his way here from New York to surrender himself under an indictment charging him with inciting riots among the silk mill strikers.

Ten thousand strikers had gathered at the Erie Railroad station here this morning to meet Haywood and to witness his arrest, and to escort him to the jail. Fearing a disturbance if the arrest was made here, Sheriff Radcliff arrested Haywood at Passaic.

The strike leader accepted arrest calmly. He was brought here from Passaic in an automobile and was released on bail soon after his arrival. He hurried to Turner Hall to make a speech to a big crowd of strikers.

When the leader was taken from the train at Passaic, he was quickly surrounded by a crowd, which shouted "duck him in the river." The demonstration became so threatening the Sheriff called on several policemen to help him escort the prisoner to an automobile.

THOUGHT TRIAL WAS HEARING

Husband Loses Divorce When Wife Tells Why She Didn't Contest.

Mrs. Margaret A. Gansz, 1074 South Kingshighway, appeared yesterday in Circuit Judge Rassieur's court and testified in the divorce suit of her husband, John J. Gansz, 1829 Market street, although she did not contest the case.

She said her husband has been visiting her every week.

She was asked by her husband's attorney why she did not contest the suit. She said her husband told her the case was not to be tried for sixty days and that yesterday's proceeding was only a "hearing." She thought she had plenty of time, she said.

Gansz denied her statements and said he had called upon her only a few times about business matters.

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liberation."

William K. Bixby,
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Simmons Takes

E. C. Simmons, a
rector, who has serve
took a similar stand
was no need for has

Friends of Mr. Ra
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Mr. Randolph decl
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He owns a large
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the institution.

Autoists Arrested

Robert G. Kobusc
avenue, and Wesley
street, were arreste
the automobile in
riding collided with
at Bissell street an
nue. George Hentz
who were in the bu
thrown to the st
bruises. Kobusch an
up at the Angelica
tion, charged with

Forty-Two Pass N

ANNAPOLIS, Md.
two candidates fo
Naval Academy as
cided to be accepta
Academic Board thi
lengthy session.

Stock No. 9.

Hemlock.

livided one-fourth interest........ 1

IKA—35 ft.. n. s.. bet. Compton l Virginia, c. b., 2742; John E. ertowski and wife to Simon J. linski 1,155

N—50 ft.. s. s.. west of Grand, b. 2960; Becker Realty Co. to a J. Pfennighausen............... 100

ADIE—40 ft. n. s. west of ion, c. b. 5247; Paul Haanel, by stee, to Joseph B. Niermann—s d............................. 2,142

—30 ft., n. s., being 4329 Lee, c. 3573W; Mary J. Bottger and husd to William J. Beattie........... 100

AS—25 ft., s. s., bet. Garrison and npton, c. b. 1023; Stellar Realty to Cedars Realty Co............ 1

NESOTA—35 ft., e. s., bet. Magia and Pestalozzi, c. b. 1428; Elizeth Hutchinson and husband to lliam N. Hutchinson............... 1

SOURI—50 ft., e. s., bet. Cherokee l Potomac, c. b. 1555; Emma iwier to Hilda Schwier et al., tc. d.............................. 1

CHESTER—50 ft., n. s., bet. Newad and Taylor, c. b. 5108; Ella ller to Arthur C. Schacht......... 1

CHESTER—50 ft., n. s., bet. Newad and Taylor, c. b. 5108; Lynna alty and Investment Co. to Ella ller 1

NESOTA—35 ft., e. s., bet. Magia and Pestalozzi, c. b. 1428; Wilm N. Hutchinson to Frank Hutchion and wife...................... 1

CHESTER—50 ft., n. s., bet. wer Grove and Newstead, c. b. 12B; Joseph G. Doyon and wife to y C. Higley....................... 100

RGAN—76 ft. 5 in. s. s., west of venty-first, c. b. 938; Mary A. ist to Alice W. Boeckmann....... 10

RCUS—37 ft. 4¾ in., e. s., bet. argaretta and San Francisco, c. b. 28; Harry R. Walchli and wife to lius Gaitzsch and wife............ 794

WSTEAD—24 ft. 8 in., e. s., beg 3004 N. Newstead, c. b. 3619; ella Comer and husband to Earl A. hnurr 10

RTH MARKET—25 ft., s. s., being 58 North Market, c. b. 3696; Gusve C. Woelfer Sr. and wife to Otto oelfler 1

RTH MARKET—25 ft. 1½ in., s. southeast cor. Prairie, c. b. 1871; ora Kreis to Minnie Wuest........ 4,300

RTH MARKET—25 ft. 1½ in., s. s. e cor. Prairie, c. b. 1871; Mine Wuest to Board of Education—l. w. d.......................... 4,300

EOLA—30 ft., s. s., bet. Gravois d Morgan Ford, c b. 5327; Sedge- Investment Co. to Henry C. eltz and wife 100

GE—40 ft., n. s., bet. Academy d Union, c. b. 8792; Standard ealty Co. to Joseph Goldstein and ife 10

SSELL—50 ft., n. s., bet. Lawence and Thurman, c b. 4942; urgen H. Jurgens and wife to Alert Falpenhainer and wife ....

JTH STRIP—100 ft., n. s., west De Baliviere, c. b. 5539; Forest ark Land Co. to William E. ughes 18,100

JTH STRIP—100 ft., n. s., west of e Baliviere, c. b. 5539; Forest Park and Co. to William E. Hughes....20,000

JTH STRIP—100 ft., n. s., west f De Baliviere, c. b. 5539; Forest ark Land Co. to Wm. E. Hughes..17,500

UTH STRIP—100 ft., n. s., west of De Baliviere, c. b. 5539; Forest Park and Co. to W. K. Bixby...........18,100

UTH STRIP—100 ft., n. s., east of kinker, c. b. 5539; Forest Park and Co to W. K. Bixby...........19,400

UTH STRIP—100 ft., n. s., west of De Baliviere, c. b. 5539; Forest Park and Co. to W. K. Bixby...........17,500

UTH STRIP—100 ft., n. s., west of De Baliviere, c. b. 5539; Forest Park and Co. to Daniel Catlin...........20,000

UTH STRIP—150 ft., n. s., east of De Baliviere, c. b 3873; Forest Park and Co. to Daniel Catlin...........30,000

UTH STRIP—100 ft., n. s., east of Skinker, c. b. 5539; Forest Park and Co. to Daniel Catlin...........20,000

THERLAND—30 ft., s. s., bet. Kingshighway and Brannon, c. b. 5165; Bedford Harris et al. to Stephan C. Jakoubek and wife—all nterest 435

LLIVAN—25 ft., n. s., being 2713 Sullivan, c. b. 2374; Fred Grothnann and wife to Mary Duerbeck.. 10

IERIDAN—30 ft., n. s., being 3123 Sheridan, c. b. 1984; Ben Rubins and wife to Michael Smith............. 10

THERLAND—30 ft., s. s., bet. Kingshighway and Brannon, c. b. 5165; Elene M. Harris to Stephan C. Jakoubek and wife.................. 435

ENNESSEE—90 ft., w. s., bet. Osceoa and Neosho, c. b. 2730; Ambrose Buerger and wife to Edna F. Jost.... 5

ENNESSEE—90 ft., w. s., bet. Osceoa and Neosho, c. b. 2730; Edna F.

burg, Ind., twenty-five miles west of Cincinnati.

The loss of the Lawrenceburg bridge was one of the most serious troubles experienced by the B. & O., during the high water, since it caused a break in the line and suspension of direct service between Cincinnati and St. Louis.

The total length of the bridge was 1,240 feet, of which 820 feet of steel work was swept away. Other bridges were lost also, but [illegible]re smaller, and when replaced two weeks ago train service was restored between Cincinnati and St. Louis by way of Louisville.

Reconstruction work on the Lawrenceburg bridge was seriously interfered with by the continued high stage of the Miami River, the swiftness of the current and other extraordinary conditions.

Road Gets Bonus From Hot Springs.

MURFREESBIRO, Ark., April 28.—The managers of the Memphis, Dallas & Gulf Railroad Company have accepted a $60,000 bonus from Hot Springs and will extend the road to that city as soon as possible. About ten miles of the right of way has been laid out, and grading and laying of track will begin at once.

Peoria & Pekin Meeting on May 1.

BLOOMINGTON, Ill., April 28.—The annual meeting of the directors of the Peoria & Pekin Union Terminal Company has been called for May 1 in Chicago. The election of officers, including chairman of the board, will be the principal business to come up. H. L. Pinkey is president.

Building Permits.

Thomas Kelly, 1110 North Eighth, wreck; $1,000.

M., K. & T. Ry., 1600 North Broadway, 1601-09 North Second, 207 Mullanphy, alter freight depot; $30,000.

M., K. & T. Ry., 210 Mound, steel and wood platform; $7,500.

Thomas Russell, 4354 Neosho, one-story dwelling; $2,000.

McLain O. Sanitarium, 907 Aubert, move office; $1,200.

M. E. Sheets, 4350-52 Gibson, two two-story flats; $8,000.

William Happel, 4943-43A Lansdowne, two-story flat; $3,500.

John Holden, 3646-46A Lafayette, two-story flat; $6,000.

William B. Ittner, 5553 Bartmer, one-story garage; $500.

J. C. Kupferle Investment Company, 827 Cass, concrete foundation warehouse; $2,000.

A. Skaggs, 2605-7-11 East Arlington, three two-story dwellings; $6,000.

Jessie Morris Realty and Investment Company, 4352 Arsenal, two-story dwelling; $3,500.

Landes Machine Company, 2500 Mullanphy, addition to factory; $8,000.

M. Szepanski, 3915-15A Marcus, two-story flat; $4,500.

H. W. Hamilton, 2838-42-44 Euclid, three two-story dwellings; $9,000.

B. Kaufmann, 6225 South Broadway, two-story flat; $2,000.

L. D. Bias, 5415 Neosho, two-story dwelling; $1,500.

St. Clair County Realty Transfers.

John B. Simonin Sr., and wife to Lena A. Brueggemann, lot 7, block 3, Simonins; $450.

James M. Wilson to James F. Hazelrigg, lots 11 and 12, block 25, Alta Sita; $1.

Joseph N. Keys et al. to James F. Galvin, lots 13 and 14, block 4, McKinley; $1.

H. P. Taussig and wife to William Sheets, lots 20 and 21, block 6, Trendley Heights; $2,000.

F. J. Wagner and wife to M. R. Lyons, north 20 feet, lot 24, J. C. Hamilton's first addition, north division of Marissa; $350.

H. J. De Haan et al. to Anna E. Lewis,

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$3,000,000, the mir
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Rocky Mountai

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March, 1913, th
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269.45. The net r
was $35,807.33, or

Railro

NEW YORK,
earnings:

C. N. O. & T. P.—
777, decrease $6.06
917, increase $146,

Louisville & Nas
$1,875,825, increase
$48,097,482, increas

Minneapolis &
April $179,158, inc
1 $8,061,713, increa

Mobile & Ohio—
459, increase $80,4
118 increase $682.

Rio Grande Sou
$13,789, increase $3
881, increase $124.

Southern Railwa
$1,306,485, increase
$55,917,176, increas

Northern Pacific
come, $5,619,874,
earnings $2,088,23
net earnings $2,0
net income $1,703,

STOCKHOLI

ST. LOUIS, IRON
ERN RAII

Special Stockhol
hereby given that
stockholders of St.
Southern Railway
the principal offic
Missouri Pacific b
Louis, in the State
day of June, 1913
noon of that day,
the following prop

1. To consent t
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1912, to Union Tr
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2. To ratify pr
Directors theretof
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3. To consider
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meeting.

The stock trans
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day, the thirty-fi
will remain close
Wednesday, the e

Dated April 8, 1
By order of the

to $3.50 per 1½-bu.
v Orleans (new) single
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er, under larger offer-
ir demand; poor stock
Mississippi hampers at
5 hampers sold at $2.
lome-grown sold at 3c
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. loose; orders higher.
sold loose at 15c per

rown leaf lettuce in
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_Louisiana flour bbls.
.5.
e. Quote choice New
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Quote New Orleans
doz. to the bbl.) at
and 30@35 doz. to the
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Quote Northern half-

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for choice; off stock

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box loose and un-
New Orleans at 10@
and 20@25c for large

ote city make in a
s 55c; half-bbls. $1.10
casks $3.50; orders

ee.
28.—Coffee futures
advance of 2 to 5
eady European cables
r 4 or 5 points dur-
g of shorts and scat-
med to be promoted
razilian markets and
ot demand. Offerings
sufficient to cause
ne positions in the
close steady. Sales
11.15c; June 11.23c;
c; Sept., Oct., Nov.
11.49c; Feb. 11.50c;
offee steady; Rio 7s
; mild coffee quiet;
minal. Havre ¼@½
g unchanged to ¼
reis higher at 6$675.
azilian port receipts
t year. Jundiahy re-
000 last year. To-
rted the market un-
eipts for 2 days, 4.-
revious day.

ee Futures.

Bro. & Co., 214 North

	High.	Low.	Close.
	....	....	11.49@50
	....	....	11.50@53
	55	11.50	11.53@55
	....	....	11.15@17
	15	11.10	11.15@17
	....	....	11.23@25
	29	11.24	11.27@28
	....	....	11.37@38
	49	11.45	11.48@49
	....	....	11.48@49
	....	....	11.48@49
	50	11.44	11.48@49

t Market.

Walker & Co., 307

	Bid.	Asked.
....	114	116
....	....	119½
....	1	1½
....	31¼	32½
....	92	93
....	116½	....

Hav. Tob...	......	.....	.....	.....	3½@ 4
Do. pfd...	......	.....	.....	.....	7 @ 10
Houston Oil	......	.....	.....	.....	19 @ 19½
Do. pfd...	......	.....	.....	.....	60 @ 61
Int. Rubber.	......	.....	.....	.....	9½@ 10½
L. V. Coal S	......	.....	.....	.....	215 @225
Man. Trans.	1,500	1⅜	1½	1¼	1⅜@ 1½
P. G. & E...	......	53	53	53	52 @ 54
Emerson B.	......	.....	.....	.....	35 @ 45
Do. pfd...	......	.....	.....	.....	86 @ 91
Standard Oil of N. J...	150	343	343	338	338 @340
Tob. Prod...	......	.....	.....	.....	110 @130
Do. pfd....	2,000	82½	85	79½	83 @ 86
U. Cigar Sts	5,000	88	89½	87¾	88¾@ 89
U.S. L. & H	......	.....	.....	.....	11 @ 13
Do. pfd...	......	.....	.....	.....	65 @ 70
MINES.					
Alaska Cop.	100	5⅛	5⅛	5⅛	5 @ 5⅛
Braden	2,000	7⅞	7⅞	7½	7½@ 7¾
Br. Col. Cop	800	2¾	2⅞	2¾	2¾@ 2⅞
Florence	......	.....	.....	.....	40 @ 45
Giroux	800	1⅞	2⅛	1⅞	2 @ 2⅛
Greene Can.	700	6⅝	6⅞	6⅝	6⅝@ 6⅞
Kerr Lake..	......	.....	.....	.....	3⅛@ 3¼
La Rose.....	300	2*7	2*7	2⅜	2⅜@ 2½
M. of Am...	......	.....	.....	.....	2½@ 2¾
McK. Dar...	300	1*15	1.15	1.15	1.15@ 2
Mason Val..	100	6½	6½	6½	6½@ 6¾
Nipissing ..	......	.....	.....	.....	8⅞@ 9
Ohio Cop...	500	1*11	1*11	1⅝	⅞@ 15*
Tonopah ...	......	.....	.....	.....	2⅛@ 2¼
Yukon Gold	......	.....	.....	.....	2½@ 2⅝
BONDS.					
N. Y. C. 4½s of 1960....	......	.....	.....	.....	96⅛@ 96½
W. P. 5s....	......	.....	.....	.....	81 @ 82

*Indicates fractions in sixteenths.

Philadelphia Stock Quotations.

PHILADELPHIA, Pa., April 28.—To-day's stock market was moderately active. Closing prices:

	Bid.	Asked.
American Railways	38	38¼
Cambria Steel	49¼	49¾
Con. Traction (New Jersey)	73½	74
E. & P. 4s	83¾	83⅞
Electric Storage Battery	48	49
General Asphalt	37½	38
Do. pfd	74	74½
Lake Superior Corp	27	28
Lehigh Navigation	86½	87½
Lehigh Valley	77¼	77⅜
Pennsylvania Salt	104	104¼
Pennsylvania Steel pfd	68½	69
Philadelphia Company	43⅞	44¼
Do. pfd	39	39¼
Philadelphia Electric	22⅛	22⅜
Philadelphia Rapid Transit	24¼	24½
Philadelphia Traction	82¼	82½
Tonopah	6⅛	6⅜
Union Traction	50	50¼
United Gas Improvement	85⅛	85½
Warwick	10½	10¾
Welsbach Company 5s	92	92¼

Domestic Exchange.

Reported by Whitaker & Co., 300 North Fourth street.

	Bid.	Asked.
New York	30c prem	40c prem
Chicago	25c prem	30c prem
Cincinnati	10c dis	par
Louisville	30c dis	20c dis
New Orleans	10c dis	par

Foreign Exchange.

The Mercantile Trust Company quotes foreign exchange as follows:

Cable transfers, London	4.8780
Check, London	4.8725
Sixty days, London	4.83
Check, Germany	95.50
Check, Paris	5.1875
Check, Switzerland	5.1940
Check, Belgium	5.20
Check, Austria	20.40
Check, Holland	40.30

Market firm.

Foreign Market Conditions.

LONDON, April 28.—Money was in good demand and discount rates were firmer to-day. The bulk of the $6,125,000 new gold offered in the open market was taken by the Bank of England. The latest development in Albania caused uneasiness on the Stock Exchange. The market opened weak under local and Continental liquidation, and there was a general setback in speculative issues, while gilt-edged securities were sold in order to exchange into the Brazilian and Chinese loans, which are expected shortly. The market closed weak and practically at the lowest point. American securities opened irregular and dull. Active realizing followed and most of the list fell below parity before noon. New York selling caused further declines in the late trading and the closing was easy.

BERLIN.

BERLIN, April 28.—The Boerse was weak and nervous to-day, owing to the Scutari situation. Russian bank shares were depressed and prices generally declined from 2 to 3 points.

PARIS.

PARIS, April 28.—Prices were weak on the Bourse to-day.

United States Treasury Statement

2 C M & St P cvt 4½s.....101½
1...101¼ 4...101⅛
5 C M & St P 4½s, receipts full paid.....101½
54...101⅛ 1...101
1 C M & St P deb 4s, 1934.. 86
1 C M & St P 5s, C & P W div 102⅞
6...103
1 C M & St P 5s, D & R G div 100⅝
1 C & N con 7s 103
2 C & N 5s, 1921 .... 99⅞
17 C R I & P rfg 4s........ 84
14 C R I & P col 4s........ 60
5 Colo F & I gen 5s........ 95
1 Colo & Sou 1st 4s........ 90
6 Colo & Sou rfg 4s........ 91½
14... 91¼ 20... 90¾
6 D & H cvt 4s 97
1 D & R G rfg 5s 78½
4 Det Un Rys 4½s 71½
1 Dist Sec Cor 5s 64½
4... 64
1 Dupont Pow 4½s 85
5... 84⅞
1 Erie 1st con 7s 113
10 Erie gen lien 4s 72
5 Erie cvt 4s, ser A........ 73⅛
10 Erie cvt 4s, ser B........ 69¾
5... 70 10... 69½
1... 69⅞
1 Gen Motor skg fd 6s........ 98⅞
15... 98¾ 4... 98½
4 G B & W deb B 13½
4 Ill Steel deb 4½s 86½
5 Ind Steel 5s.. 99¾
1 Ins Con Cop 6s, receipts 3d paid.....102¾
5 Int-Met 4½s. 75⅛
10... 75 46... 74⅞
2... 74¾ 21... 74⅞
4... 74⅝ 13... 74½
2... 74⅝ 17... 74⅝
25... 74¼ 21... 74⅛
7... 74¼ 1... 74½
14... 74⅜ 27... 74¼

of N J 5s
1... 91⅜
1 Ray Con
6s ......
1 ..108½
6 Reading
4s ......
1... 94⅞
1 St L I M
rfg 4s...
3 St L & S
gen 5s...
7... 78
6 St L & S
rfg 4s...
8... 73¼
1 St P & S
6s ......
3 S A & A
5 S A L 4
stamped
1 Sou Bell
T 5s.. ...
5 Sou Pac
4s ......
2... 87⅜
9... 87¾
15 Sou Pac r
4s ......
1... 89⅛ 1
2 Sou Ry 4s
5... 76⅛ 5
10... 75⅞
1 Third Av
4s ......
1... 79⅛
2 Third Av a
5s ......
1... 68 5
1... 68⅜ 5
1 T St L &
50-yr 4s..
5 Un Pac cvt
18... 91
2 Uni Rys of
F 4s......
10 U S R & I
2 U S Rubb
6s ......
6... 102¼
37 U S Steel s
fd 5s......
1... 100¾ 22
5... 101 8
2 Va C C 5s
2 Wab 1st 5
8 Wab rfg 4
12... 57⅛ 4
4... 57¼ 1
6 Wab P Te
1st 4s, Cen
ctfs ......
15... 17 10
5 West El 5
2... 102
10 West Mfg
1... 91½
2 West Mfg
pct notes..
6 West Sho
1 Wis Cen 4s

Total sales, $1,921,000.

Stocks at Boston.

BOSTON, Mass., April 28.—Closing quotations to-day were as follows:

Allouez	33	Mohawk ......
Amal. Copper..	72⅝	Nevada Con..
Am. Z., L. & S.	25⅝	Nipissing Min
Arizona Com'l.	21 5-16	North Butte..
B. & C. C. & S.M.	4¾	North Lake...
Cal. & Arizona..	63⅝	Old Dominion.
Cal. & Hecla...	465	Osceola ......
Centennial	13⅛	Quincy ......
Copper R. Con..	43	Shannon .....
E. Butte Copper	11½	Superior .....
Franklin	6⅛	Sup. & Boston
Giroux Con....	2 1-16	Tamarack ....
Granby Con.....	61½	United Shoe M
Greene Cananea.	6¾	U. S. S., R. &
Isle Royale.....	24	Do. pfd.....
Kerr Lake......	3⅛	Utah Con.....
Lake Copper....	12⅝	Utah Copper..
La Salle Copper.	3⅜	Winona ......
Miami Copper...	24	Wolverine ...

New York Mining Stocks.

NEW YORK, April 28.—Closing quotations to-day were as follows:

Com. Tun. stock	8	Mexican .....
*Do. bonds....	12	Ontario ......
Con. Cal. & Va..	18	Ophir ....
Iron Silver......	125	Small Hopes..
*Leadville Con..	10	*Standard ...
Little Chief.....	3	Yellow Jacket

*Offered.

Short-Time Bonds and Notes.

Reported by Francis, Bro. & Co., North Fourth street.

Security.	Due.	Bid.
Amal. Copper 5s...April,	1913	98⅜
B. & St. L. Ry. 5s..July,	1913	100
B. & O. 4½s.......June,	1913	100
C. & O. 4½s6......June,	1914	99
C., H. & D. 4s.......July,	1914	99⅞
Comp. Hts. Ry. 6s..July,	1913	100
Erie Ry. Co. 6s....April,	1914	100¼
Int. Harvester 5s...Feb.,	1915	99⅝
Lack. Steel 5s....March,	1915	95

Stock No. 11.

Tamarack.

[...]tch
[...]arge

Broadway at Locust

[...]SS MACKIN IS HERE

[...]60, Who Danced With King, [...]ttend Peace Congress.

[...] Spottsgood Mackin (Sallie [...] who danced with the late [...]ard VII when he visited St. [...]e Prince of Wales, is a guest [...]efferson and will attend the [...]gress.

[...]ntess Mackin is the daughter [...]e Mayor James H. Britton of [...]and for many years she was [...] leader of St. Louis.

[...] the Prince of Wales, who [...] King Edward VII, spent sev-[...] in St. Louis.

[...]ter ball was given in his [...]iss Sallie Britton led the [...]ch with the Prince of Wales. [...]er St. Louis society belle is [...]ident of Paris, France.

[...]plosive Is Most Powerful.

[...] April 28.—Prof. Arsene d'Ar-[...] the College of France has [...] a new explosive, said to be [...] more powerful than dyna-[...]e explosive is a combination [...]black and liquified gas. Ex-[...] in quarries near Paris have [...]arkable results.

[...] the delivery had not been made.

"Ha, ha," laughed Schoenky, "I was put wise to you fellows. You are policemen and are trying to arrest me for selling less than five gallons of liquor at one sale without a retail liquor license. Well, I won't deliver the beer, that's all."

"No, that isn't all," returned Phelan, waving the receipt. "Either deliver that beer, or I will arrest you for obtaining money under false pretense."

The beer was delivered and the liquor license charge was placed against Schoenky.

Julius Schira, vice president and manager of the Conrad Grocery Company, was fined $100 and costs on a charge of selling liquor in less than five-gallon lots. Judge Miller reduced the fine to $50 and costs.

VICE ATTACK "PLOT" FAILS

Attorneys for Girl Witnesses Forced to Quit Illinois Hearing.

SPRINGFIELD, Ill., April 29.—A "plot" to attack members of the Illinois Legislative "White-Slave" Commission and an attempt by two Springfield attorneys to force themselves into the quiz by acting as volunteer counsel for girl witnesses featured the session to-night.

The "plot" turned out to be a hoax, a Deputy Sheriff having told one of the commission's officers that the Sheriff would be on hand at the session to "run things."

It was taken seriously, however, as the police were on hand and were requested by Lieut. Gov. O'Hara to keep order.

The attempt by Attorneys A. M. Fitzgerald and C. E. Mortimer to address the commission was productive of much uproar, laughter and jeering.

They were aided by the sympathy of the crowd which attended the hearing. Neither was permitted to make a speech and they left the hall as O'Hara called on the sergeant-at-arms to put them in their seats.

The only witnesses examined were several girls employed at the local shoe factory. It was not announced whether any further hearing will be held in Springfield.

CRITICISES PIERCE'S MEMORY

Financier at $1,500,000 Hearing Fails to Recall Transactions.

The depositions in the suit of the National Bank of Commerce against H. Clay Pierce to recover $1,500,000, the value of stock in the Nashville Terminal Company, which the bank claims Pierce has, although it was pledged to secure loans, will be resumed at 10:30 o'clock to-morrow morning before Special Commissioner Hugo Muench.

Mr. Pierce was on the stand yesterday and his inability to remember transactions by him and his agents in matters pertaining to the Nashville Terminal Company securities provoked sharp criticism from Attorney George Lockett Edwards, who is representing [...]

original plan, so she m[...] of the wedding to yest[...] the ceremony was not [...] "ill-fated" month, they [...] have the ceremony pe[...] month of showers.

Mrs. Saxe has beau[...] hair, and is one of the [...] young matrons in Jew[...] first husband, Julius [...] years ago. She has tw[...] 19 years old and a d[...] old.

A year ago Mrs. Saxe [...] Mrs. Bertha Newman, [...] fellow boulevard, wen[...] Springs, Ind. While th[...] May, who is a retir[...] Charleston, being the [...] Schwab & May depa[...] that city.

R. T. CRANE'S WI[...]

F. A. Junkin and Wi[...] Be United i[...]

PARIS, April 29.—F[...]kin and Mrs. Richard [...] Chicago, will be marri[...] can Church of the Ho[...] at 4 o'clock to-morro[...] invitations have been [...] friends and relatives [...] present. Since the eng[...] nounced at the begi[...] Mrs. Crane and her n[...] living in Egypt. Mr. [...] Paris and met them a[...]

CHICAGO, Ill., April [...]ciety is interested in [...] Paris to-morrow of F[...]kin and Mrs. Richard [...] of the iron master, wh[...] years ago. Mr. Junk[...] lawyer and was a fr[...]hood. He is a son of I[...]ny Junkin of Rockbr[...] Mr. Junkin is a mer[...] New York and Chicag[...]

Mrs. Crane, who wa[...]son, and Mr. Junkin w[...] before she met the ag[...]

GIRLS DRINK QU[...]

Granite Cityans, 11 [...] Mistook It f[...]

Christina Duffy, 11 [...] her sister, Helen, 8, [...]rick Duffy, Twenty[...] streets, Granite City, [...] as the result of dri[...] whisky they had mi[...] water.

The girls, who are [...] Ward, who rooms at [...] Claude Pool, 2144 Elm [...] to their uncle's roo[...] candy and apples, w[...] them were there. They [...] and also the whisky.

At 3 o'clock Mrs. Po[...] children lying on the [...] of the house, uncons[...] for Dr. B. H. King.

The physician said [...] both are in a seriou[...] will recover.

rican kiss.
lation that could be
seen by the members
c and congressional
attend the Jefferson
at Forest Park and
. Louis on the same
stinguished English-

ly and bridal party,
mother, Hon. Lady
Misses Violet and
Sir John Shelley and
A. Benyon, who is
" man at the Peek-
ng to be solemnized
in St. Louis this aft-
ained in New York

ty is to be guests of
illan at 25 Portland
ne the home of Miss

chaperoned.

and several friends
at Union Station,
and his future bride
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mother of Sir Wil-
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's home.
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Union Station to the
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n a Hurry.

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ieged by newspaper-

frid Peek?" inquired

a hurry," he replied.
us go, we are late
Thornbourgh, plead-
vas an hour late.
oubles were adjudi-
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'
going to stay during
city?" he was asked.
some hotel and re-
dding. My mother
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ng Sir Wilfrid too
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going to help Sir
r Thomas Lipton as

Holdings of City Sales Manager Estimated at More Than $4,000,000.

Edwin A. Lemp, one of the six principal stockholders of the Lemp Brewing Company, has withdrawn from the company and disposed of his interests, following differences with his brothers over the management of the big concern.

E. A. Lemp is the second of the heirs of William J. Lemp to withdraw, Louis Lemp having sold out his interests to other members of the family about seven years ago.

Not one share of stock in the concern has been held by any but a member of the Lemp family since the brewery was founded by Adam Lemp, seventy-three years ago, and it is understood all Eddie Lemp's stock has been bought by his brothers, Charles A. and William J. Lemp Jr.

When seen last night Mr. Lemp declined to discuss his withdrawal other than to say "business differences had occasioned it."

"There is no personal feeling in this matter at all," he said, "and although my brother Charlie and I didn't get along very well, that had nothing to do with my selling out.

"My brother Louis withdrew because he wanted to live in New York and was tired of the business cares, but you can bet I'll stay right here in St. Louis. I have not made any plans, but this little old town is good enough for me or any other man on earth."

Charles A. Lemp declared his brother withdrew from the business because he was tired of working and wished to take life easy for the remainder of his days.

Eddie was manager of the city sales department and was known generally about town as a "good fellow." He has spent a great portion of his time during the last few years at the Lemp farm on the Meramec River.

It is estimated Eddie's holdings in the brewery were worth more than $4,000,000.

His last acts as an official of the company will be taken to-day, as he will retire permanently from the business to-morrow.

JILTED, GOES GUNNING, HELD

Frank Gurvis, 21, Crossed in Love, Threatens Storekeeper.

Frank Gurvis, 21 years old, who after he had been crossed in love caused a reign of terror at Garrison and Washington avenues, yesterday afternoon was arrested charged with flourishing a deadly weapon.

Gurvis had been lavishing his attentions on Lola Blake, 17 years old, of 2951 Washington avenue, but his affection was not returned.

Lola asked her half brother, E. B. Whitworth, who owns a grocery at 2947

ing by the stairs of the Gove
a military escort under cor
Gen. E. J. Spencer.

Francis to Call Assemb

President Francis will call t
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conducted in the open, on the
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J. Niccolls of the Second Pre
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The unveiling of the statue
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The Mayor will respond,
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Descendant to Unveil Ta

The tablet commemorative
event which the Exposition wa
to celebrate and from which
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3966 De Tonty street, also a
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same degree as Miss Norton,
different branch.
Following the unveiling of
let, Senator W. L. Jones of
ton will deliver an address, a
the educational and militar
will pass in review before
Francis, Govs. Dunne and Ma
Kiel and the congressional d
The parade will be an hour
a given point. It will move
on Lindell boulevard and wil
to reach the Memorial struct

Continued on Page Fi

THE WEATHER.

TO-DAY'S FORECAST

For St. Louis and Vicinity—Fair
er to-day. Thursday, probably fa

YESTERDAY'S CONDITIC

Barometer—At 7 a. m., 30.17 i
p. m., 30.11 inches. Temperature—
70 degrees; minimum, 47 degrees.
—At 7 a. m., 57 per cent; at 7 p.
cent. Wind—Direction at 7 a.
east; at 7 p. m., east; velocity at
miles an hour; at 7 p. m., 8 mil
Precipitation, none. Weather—A
clear; at 7 p. m., clear.

LIGHT LAMPS, ALL VEHICLES,

Stage of the river at 7 a. m., 1

Sun rises at 5:03 and sets at 6:
of day, 13 hours and 47 minutes.

THERMOMETER READI

1 a. m....54 degrees | 1 p. m....

Stock No. 12.

Tamarack.

STEEL EARNS LESS THAN LAST QUARTER

Figures, Though, Are Higher Than Those of Corresponding Period of Last Year.

NEW YORK, April 29.—The financial statement of the United States Steel Corporation for the first quarter of this year, issued to-day, shows total earnings of $34,426,801 and net income of $25,696,509.

These marked decreases of $758,756 and $68,417, respectively, compared with the quarter immediately preceding, but are much in excess of the corresponding quarter of 1912, when total earnings aggregated only $17,826,-973, and net $12,108,415.

Surplus for the quarter amounts to $7,369,000, as against a deficit of $6,-292,134 in the same quarter last year.

The statement was under general estimates, which ran all the way from $36,000,000 to $40,000,000. While no official explanation was vouchsafed, it is understood that the recent floods affected the corporation's earnings to the extent of at least $2,000,000. It is considered not improbable that this same cause may find further reflection in the current quarter.

Chairman Gary, contrary to his usual custom, did not issue any statement dealing with the outlook in the industry, but it was said that orders now on the corporation books are sufficient to keep its plants busy for the rest of the year.

The usual quarterly dividends of 1¾ per cent on the preferred stock, and 1¼ per cent on the common, amounting to $12,658,700, were declared. The board reorganized by re-electing all its retiring officers.

Miscellaneous Markets.

Tamarack.

GRASS SEEDS—[illegible] and unchanged; some demand for millet and good timothy, but no call for clover. Prices easy or nominal; offerings next to nothing. Quote: Millet—Trashy, mixed, etc., 70c to $1; bright, clean, sound at $1.25 @1.40—prime German at $1.45 to $1.50; Hungarian at $1.15@1.30; timothy [illegible] for tailings to $2.[illegible]@2.50 for [illegible] $2.00 @3 for fair and $3.20@3.35 for prime; clover at from $5@10 for weedy to $15 for the best good average run; redtop at $8@9 for recleaned seed—inferior grades, trashy, etc., less. Sales: 12 sks. timothy at $3.38; 59 sks. timothy at $3.36; small lots very fair clover at $7 and $8.

Stock No. 12.

STOCK PEAS—Quotable per bu. at from $1.50 to $1.80.

SORGHUM-CANE SEED—Quotable at 90c to $1.15 per 100 lbs., according to quality.

SUNFLOWER SEED—Quotable at $2.75@3.50 per 100 lbs.

DRIED FRUIT—Little or none offering; prices nominal; sun-dried quarters apples at 2@2½c; evaporated rings apples at from 3c for ordinary to 4c for choice; sun-dried peaches at 5c to 5½c; cores and peelings apples ½@¾c

IMPROVED QUALITY IN NATIVE BEEVES

Best Make Top of $8.40—Cattle Prices Generally Weak to 10c to 15c Lower.

RECEIPTS.

Cattle	2,860
Hogs	11,000
Sheep	1,500
Horses and mules	500

NATIVE CATTLE—Beef Steers—A good supply showed up, but the market was draggy and values lower. Quality was improved, yet it was nothing to boast of. Heavy beeves made up a good part of the supply and this variety suffered most. The best price was $8.40, paid for 3 cars of Colorado pulp-fed steers. Good, weighty beeves changed hands from $7.85 to the top, and looked 10@15c lower. Medium weights of quality sold from steady to a shade lower at $7.50@8.25. Inferior grades, both of medium and heavy weight class, changed hands from $7@7.50. The clearance was fairly good.

BEEF AND BUTCHER STEERS.

No.	Av.	Pr.	No.	Av.	Pr.	No.	Av.	Pr.
51..	1430	$8.40	51..	1387	$8.35	20..	1040	$8.10
20..	1270	8.25	24..	1066	8.00	29..	848	7.75
43..	1064	7.70	9..	834	7.50	10..	956	7.35
7..	575	7.00	22..	744	6.85			

Cows, Heifers and Bulls—Butcher cattle were weak and cows and heifers suffered a decline, varying according to quality. A fairly healthy supply was in, and more choice ones were noticeable. Heifers were plentiful and rather dull. Choice corn-fed offerings from Illinois topped at $8.50, but this was the only high spot touched, balance of the best clearing at $7.75@8.25, 10 @15c off. Medium grade offerings cleared in a spread of $6.75@7.50.

Cows were in fair numbers, and included some good quality. Both packers and order buyers started bidding 25c lower, and salesmen were compelled to liquidate on this basis. Best cows netted from $7@7.25, a good 25c lower. The rank and file of cows, embracing the fair to good grades clearing in a range of $5.75@6.75, and offerings bordering on the cutter class, selling from $5.25@5.50 also moved 25c lower. A good supply of canner and cutter material from "Q" territory left little room for natives and these kinds suffered with the balance of butcher material. Bulls were about the only exception, selling steady to a shade lower at $6.50@7.25.

HEIFERS.

No.	Av.	Pr.	No.	Av.	Pr.	No.	Av.	Pr.
23..	783	$8.50	66..	558	$8.25	8..	450	$8.00
26..	590	7.75	4..	700	7.50	17..	688	7.00
2..	400	6.50	26..	544	6.25	3..	643	7.25

COWS.

No.	Av.	Pr.	No.	Av.	Pr.	No.	Av.	Pr.
3..	700	7.05	8..	1100	7.00	10..	943	6.80
3..	976	6.50	1..	880	5.75	3..	552	5.25
1..	750	5.00	1..	780	4.65	3..	766	4.00
1..	750	5.00	1..	780	4.65	3..	766	4.00
1..	710	3.50						

BULLS.

No.	Av.	Pr.	No.	Av.	Pr.	No.	Av.	Pr.
1..	1570	7.25	1..	1020	7.00	1..	1150	6.75
2..	920	6.50	1..	790	5.85	2..	455	4.75

Calves and Yearlings—The supply of veals was light, with prime kinds lacking, and prices on all classes of yearlings were about steady. The top was $10.50. Most of the good grade vealers changed hands from $10 @10.25. Common to good kinds sold from $8.50@9.50. The supply of yearlings was light, very few bunches being sold. Medium weights cleared from $7.50@8, heavies sold from $6.50@7.25. A few odd lots sold above and below these ranges, but they were of little consequence.

CALVES AND YEARLINGS.

No.	Av.	Pr.	No.	Av.	Pr.	No.	Av.	Pr.
11..	120	$10.50	2..	175	$10.25	11..	146	$10.00
1..	100	9.50	6..	150	9.00	5..	100	8.50
1..	130	8.00	8..	108	7.50	1..	70	6.00

Stockers and Feeders — The market was very dull, due to limited supply. A good quota embraced killing kinds. Two bunches of fair steers for feeder purposes at $7 was about the only transaction worthy of note. Comparatively few cows and heifers went to stock buyers. A fair supply of milkers

—Receipts 14
tive $6@7.15
$6.50@7.90; 1
ern $7@8.80.
KANSAS C
Receipts 10,0
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Receipts 17,0
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and heifers $
Receipts 8,00
$8.15@8.25.
lambs $7.50@
SOUTH OM
Receipts 4,10
8.50; cows ar
steers $6.50@
and heifers $
—Receipts 13
light $8.20@
8.25. Sheep-
lings $7.25@7
$8.80@8.75.

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LEMONS—
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EAST ST. LOUIS.

SUPT. POTTS IS RE-ELECTED.

B. H. Canby Named President of Board of Education.

Prof. D. Walter Potts was re-elected Superintendent of the East St. Louis public schools when the new Board of Education organized yesterday.

B. H. Canby, formerly Judge of the City Court, became president of the board, succeeding Dr. R. L. Campbell, who served three terms.

The new members are Ed J. Coffey, W. H. Bray, Herman E. Mollman, Jesse Boismenue. They succeeded Fred W. Kraft, Joseph H. Kuebel, Dr. G. D. Hulick and D. J. Mulcahey. The holdover members are Dr. E. W. Cannady, H. B. Carson, A. I. Cummings, Ralph McLean, J. C. Thoman, Fred Brendle, S. J. Cashel and C. C. Molla.

President Canby appointed the following as members of the regular standing committees of the Board for the next year:

Teachers—Dr. E. Cannady, chairman, and H. B. Carson, A. I. Cummings, Ralph McLean. Finance—Stephen J. Cashel, chairman, and E. J. Coffey, J. C. Thoman, W. H. Bray. Building—Herman E. Mollman, chairman, and Fred Brendle, C. C. Molla, Jesse Boismenue. Insurance—A. I. Cummings, chairman, and Ralph McLean, Herman E. Mollman. Discipline—J. E. Thoman, chairman, and H. B. Carson, S. J. Cashel. Rules—Fred Brendle, chairman, and Dr. E. W. Cannady, W. H. Bray.

Fire Prevention Meeting To-Night.

Fire prevention, the causes of fires and how to extinguish them will be the principal topic to be discussed at the meeting of the East St. Louis Commercial Club to-night. The meeting will be held in the auditorium of the City Hall. Sidney J. Roy of Hannibal, Mo., will talk on good roads. Representatives of the Illinois Fire Prevention Bureau will address the meeting. William C. Thrasher, president of the club, will explain the object of the "Live Wire" Committee recently appointed.

Car Carries Victim to Hospital.

After their car had run down Alfred Murphy, a 14-year-old East St. Louis schoolboy, the crew of a Belleville car picked up the boy and carried him into St. Mary's Hospital. The boy had attempted to cross the street in front of the car. He lives at 1919 Summitt avenue.

ALTON.

NEW OFFICERS IGNORED.

Old Members of Town Board Reorganize Without Holding Election.

Without paying any attention whatever to the officers elected April 2, the old Town Board of Woodriver Township held a meeting yesterday morning and reorganized.

Dan Stoeckle of Bethalto, who was defeated by Fred Hendricks, refused to surrender his office, and, though defeated at the polls, held the seat and acted and voted as a member of the board, while Hendricks sat by and was not allowed to take any voice in the meeting.

Members of the Board contend the election was illegal, and though they were not candidates, they are holding onto their offices. The newly elected members will probably organize and hold meetings also, thereby giving the township two Town Boards.

BELLEVILLE.

BISHOP JOHN JANSSEN BETTER.

Chicago Prelate Departs for Home Aft... Spending Day at Bedside.

Archbishop James Quigley of Chicago ye... terday spent the day at the bedside of R... Rev. Bishop John Janssen of the Bellevil... Diocese, who was stricken with heart a... fliction last Thursday night on the eve ... the silver jubilee of his consecration ... Bishop.

Archbishop Quigley departed last night f... his home in Chicago, well pleased with th... condition of the Belleville prelate. Drs. Po... tuondo and Irwin, who have been in a... tendance at the Bishop's residence constan... ly, state they believe the Bishop has co... quered his illness and will recover.

To Be Court Reporter's Bride.

Roy White, official reporter of the S... Clair County Probate Court in Belleville, a... Miss Linda Knobeloch, daughter of Mr. a... Mrs. Henry Knobeloch of 614 East C stre... Belleville, will be married at 1 o'clock th... afternoon. Mr. White is a son of Supe... visor and Mrs. Richard White of North Il... nois street. The couple will depart th... evening on a wedding tour through the Ea... returning home in two weeks.

Brooklyn Marshal Freed.

Robert Dorsey of Brooklyn, who was unc... indictment on a charge of threatening ... shoot Constable Walter L. Ward of Bel... ville six weeks ago, was acquitted in t... Belleville Circuit Court yesterday. Consta... Ward was one of the deputies who assis... State's Attorney Webb in making the ra... on the gamblers in East St. Louis a... Brooklyn. It was charged that when Wa... rushed into a saloon which was raided ... Broklyn, Dorsey, who is Town Marsh... drew his pistol and flourished it in a thre... ening manner. The jury was out two hou...

Power Co. Gets $5,000,000 Loan.

A $5,000,000 mortgage was filed in the ... fice of Recorder of Deeds C. A. Summ... of Belleville yesterday afternoon by ... Southern Illinois Light and Power Compa... to the Continental and Commercial Tr... and Savings Bank. The mortgage, which ... at 6 per cent and matures in January, 19... is secured by all of the property of ... company. The loan is made for impro... ments.

German Evangelical Synod Elects.

The Southern Illinois District of the G... man Evangelical Synod of North Ame... elected officers as follows: President, F... G. Plassmann, Nameoki, Ill.; vice presid... Rev. William Riemeier, Carlinville, Ill.; s... retary, Rev. Daniel Buchmueller, Pocah... tas, Ill.; treasurer, Rev. John Berger, M... lson, Ill.

Boy on Skates Hits Mail Box.

An attempt to glide one way on r... skates while looking in another directio... watch a parade of Indians caused Geo... 13-year-old son of Mr. and Mrs. Her... Wirth of Belleville, to collide with a ... box. He was knocked unconscious. He ... be in bed some time.

Fritsch Estate Goes to Family.

Kilian Fritsch, who died in East St. L... April 23, makes provisions in his will, w... was filed in the Probate Court in Belle...

Stock No. 13.

Noble Fir.

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Stock No. 13.

¶ And as for to-night,
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PURE FOOD NUMBE

of

The New York Evening

SATURDAY MAGAZINE

our appetite will be something fearful. We warn you not to read it if you can't afford a squar

he Perpetual Potato

an attack on that time-honored starch bomb, by
lenry T. Finck, author of "Food and Flavor." He
commends spaghetti.

Canned Interview with a Chef,

a Foster Ware, is accompanied by other confessions
lling why the kitchen lords of big hotels are proud
f their baked beans.

ining Out in New York

made of some piquant ingredients left (in the form
f notes) by Samuel Ward, a 19th century gourmet,
or whom they still name dishes. Incidentally it traces
e history of Delmonico's.

nother Little Crucified
isters Romance

y L. J. Beeston.

Brooklyn Bridge Maligr

Simeon Strunsky, the Post-Impressioni
experiment to explain the plausibility o

Four Famously Lovely

are the flavor of this week's portion o
stage reminiscences. To wit: Adelai
Rehan, Kate Claxton, and Sara Jewe
do their youth and charm full justice

A Page of Fashions

sent direct from Paris by our ow
Florence H. Barkley.

Art—The Stage—Scien
Fair Play's Sports—Mo

There are 60 pictures in this number,
a piece of superb color work, the
"Lilian," by Robert Henri.

This magazine accompanies the New York Evening Post on Saturdays, and the
aper and magazine is only 5 cents a copy at all newsstands. ($2,50 a year by ma

all the payments on
ts for construction.
e. if possible, to have
tly after Easter, and
at $150,000, still re-
payments, must be
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a question often
Ralph Adams Cram
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MORIAL
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of the pulpit and
ried. Mr. Reiland
Mr. Morgan in has
sidered.

REV. MAXWELL GANTER

Ritchie, who becomes rector emeritus. Mr. Ganter is a son of the late Rev. Dr. R. S. Ganter, who was rector for many years of St. Paul's Episcopal Church, Akron, Ohio, where the son was born, May 31, 1883. Mr. Ganter was graduated at Kenyon College in 1904, and from Yale Graduate School in 1906. He spent the next year abroad. On returning he entered the General Theological Seminary, this city, and was graduated in 1910. He was ordained the same year in St. Thomas' Church by Bishop Sidney C. Partridge. Mr. Ganter has served as curate at St. Martin's Church, New Bedford, Mass.; Cathedral, this city; Christ Church, New Haven; St. Mark's Church, Philadelphia, and Grace Church, Newark, N. J.

Drew Methodist Theological Seminary, Madison, N. J., has established the Chair of Missions and Comparative Religions and has elected to it the Rev. Dr. Edmund Davidson Soper, professor of missions in Ohio Wesleyan University. He is the son of Dr. Julius Soper, a veteran missionary, and was born in Tokio thirty-seven years ago. The young man is a graduate of Dickinson College and of Drew Seminary. He has served as college secretary of the Pennsylvania Y. M. C. A. and as secretary of the Missionary Educational Movement.

The Rev. Frank H. Simmonds has accepted a call to Grace Episcopal Church, White Plains, N. Y., as curate to the Rev. Dr. Frederick Van Kleeck.

"GO TO CHURCH SUNDAY" HERE

West Side Churches Unite for Movement and Fix Washington's Birthday for the Date.

"Go to church Sunday" has been fixed for Washington's Birthaday by forty Protestant churches of the Manhattan west side below Forty-second street, by all on Staten Island and by those of the Far Rockaway part of Long Island. In the Bronx the preceding Saturday has been included. The west side Manhattan churches adopted a resolution urging the fixing of some future date for the whole city, but voted themselves to observe February 22.

West side churches taking parts include the University Place, First, West Twenty-third Street, Greenwich and Faith Presbyterian; Metropolitan Temple and Washington Square Methodist, Ascension, Holy Communion, Holy Apostles and St. John's Episcopal; Sixteenth Baptist and Knox Memorial Reformed.

Announcement was made of the result of a canvass made in behalf of a "go-to-church Sunday" for the entire city. Dr. S. Edward Young, pastor of the Bedford Presbyterian Church, of Brooklyn, said that the vote in favor of such a Sunday had been practically unanimous and that the third Sunday in October had been the date selected.

writes:—"It was a great help. M
our non-Christian children do n
clothing until they are six or eig
old. We, however, require our C
children to wear clothing for the
services; hence your box was a
to many parents unable to buy clot
their little ones. We overlooked
the babies, as the material wasn
cient, and they appeared clot
smiles."

Miss Mabel eParson Schmidt, w
the last year has been a member
deaconess staff of St. George's E
Church, has resigned to become a
of English in one of the public
She will continue as a volunteer w
the Sunday school.

Mrs. M. B. Norris, of the W
Board of Foreign Missions of the Re
Church, who has recently returne
Japan, will address the Woman's
of the Marble Collegiate Reformed
Monday morning in the chapel, Fif
nue and Twenty-ninth street.

The Society for Women's Work
Broadway Tabernacle, at Fif
street, will hear a lecture Tuesda
Lovell Murray, and February 24
Mills, of Schauffler Institute.

The eleventh annual meeting
Young Women's Hebrew Associati
be held at the headquarters to-
afternoon at three o'clock. The s
will be Mrs. Charles H. Israels a
Rev. Dr. David de Sola Pool. G.
Davis, chairman of the Building C
tee, will report on the association'
during the year.

A retreat for the Associates of t
ters of the Holy Nativity and other
will be held Wednesday in the Ep
Church of St. Mary the Virgin,
sixth street, east of Broadway. The
will be the Rev. Dr. Joseph G. H.
the rector.

Socialism Cha

Attorneys for Operators D
That Party Was Responsil
for Strike.

[SPECIAL DESPATCH TO THE HERA
HANCOCK, Mich., Friday.—The C
sional investigation of conditions
up to the copper strike in Michigan
is to develop some stormy pa
among the members of the Congre
committee as well as between at
representing corporations and the W
Federation of Miners.

This was indicated this afternoo
there was a discussion of socialism
the committee. Attorneys for the
companies questioned witnesses f
miners to prove the contention th
strike was born in socialism; th
federation is backed by the socialist
and that the present industrial dis

Stock No. 14.

Alpine Fir.

ng water; heat; tele
uitable married couple

s, double closets, run-
also parlor and base-

business ladies, with
ern comforts.

desirable large Room,
xcellent house, neigh-

double, single steam
sements; electricity,

running water, tele-
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ished Room, suitable
, bath. BIRD.

n, modern apartment;
me. Apt. 2 East.

an owning modern
Room, twin beds,

Room; suitable for
orhood; central; ref-

EST.
oms; shower baths,

sunny front Rooms
breakfast optional;

e southern exposed
om, bath adjoining;

Room, private bath,
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nces, quiet surround-
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st. — Furnished
Rooms, sin-
CRITTENDEN.

nt Parlor connected
ath; two gentlemen;
Room. MILLER.

exington and Park
gant large Parlor,
ellent location; Hun-

wo adjoining Rooms;
optional. EGAN.

gentlemen to share
conveniences; refer-

3F).—Large, beauti-
ns; home comforts.

men preferred; ref-

sunny Room, facing

back Parlor; hot,
vate house.

three sunny front
e flight up; private
bway; reference.
SHELLY.

—20c. agate line
k about weekly

ANTED.

SON AV.
ooms, private bath;
st excellence; mod-

ge, small Rooms;
rd; telephone; ref-

n handsome private
tionally large sec-
dressing room; also
; an ideal home;
service; references;
And.

t (97th).—Southern
rk view; elevator,
phone, 7395—River-

RTUNITY.
ith; refined Jewish
SIVE, 885 Herald.

ate line Daily
at weekly scale

VATE NURSING ARRANGED FOR PATIENTS WHEN NECESSARY. DR. GORMLEY, 128 WEST 65TH ST.

Medical—50c. agate line Daily and Sunday. Must be set solid in agate.

SPECIAL NOTICES.

To Dog Buyers

The most prominent breeders and exhibitors in the country advertise in the New York Herald Sunday Kennel Directory. Any one wanting a dog of any breed will find stock offered to meet all requirements.

WATCH FOR IT TO-MORROW.

references. Neuchson, 1,884 Arthur av., Bro

General Housework, &c.

HOUSEWORK.—General housework; lady w to place at once experienced, reliable married colored woman, with five-year-old 547 Riverside Drive, apartment 4A. Telep 3753—Morningside.

HOUSEWORK.—Would like position as vis maid or general worker for one perfectly petent; reference furnished. W. L., 216 H Harlem.

HOUSEWORKER, English, thorough, good cook, highly recommended, trustworthy. F., 415 West 34th.

HOUSEWORK.—Irish girl for housework; plain cooking; apartment. Holland, 245 94th st.

HOUSEWORK.—German, middle aged wo best reference. Care of Faas, 61 West 74

Laundresses, &c.

FRENCH laundress wants work, out by da take fine washing home. Mrs. F. Camilla, Park av., corner 157th st.

LAUNDRESS.—French laundress wants w home or out; best references; has use of dry in private house. 184 East 79th st. phone, 4560—Lenox.

LAUNDRESS.—French laundress, first wishes family washing; fine lingerie; out, preferred; large yard. 114 West 49th. Brya 6831.

LAUNDRESS, colored, wishes day's work Mo and Tuesday; Saturday cleaning. Harris, East 127th.

LAUNDRESS.—Young woman, first class dress, day, cleaning, cooking; reference. gins, 152 Amsterdam av.

LAUNDRESS.—Ladies' wash taken home, or a few hours. Myles, 126 West 100th.

LAUNDRESS.—Young girl as laundress by Donoher, 124 West 84th.

LAUNDRESS wants washing at home; open drying; reference. Piggott, 125 West 137th

Nurses, &c.

NURSE.—Trained nurse; specialty rheumati daily treatment to lady for room, board. spectable, 176 Herald.

NURSE.—German, middle age, as nurse to c dren or invalid lady. Care of Faas, 61 W 74th.

NURSE, young German girl, speaks English, on sewing, wants position to children. Sm 1,344 Amsterdam av.

NURSE, refined, very best credentials, wishes sition monthly; any chronic case; English Southern family. Address E. E., 852 Columbus

NURSE, refined German, wishes to take care child. Box 21, 1,508 2d av.

Miscellaneous.

DAYS Work.—Woman washing, ironing, clean by day; references. Mrs. Lacey, 764 Colum av.

DAY'S WORK.—Laundresses, cleaners, hou workers; washing home. Hudson Guild, West 27th. Chelsea—1481.

FARM.—Woman with three children, thoroug experienced in farm work, would take charge small place; no salary expected; best referenc Write D. R., 1,794 3d av.

MAID.—Neat young woman (colored) wishes po tion as private maid with actress; no object to small apartment; references. E. Winston, West 132d st., New York.

NEAT colored girl, maid to lady, apartment hot plain sewing. Vodery, 221 West 40th st.

WANTED—By a light colored woman, place in room or half time work. 63 Ege av., Jers City, N. J.

WOMAN goes washing, cleaning, ironing t days weekly. Slabej, 433 East 66th st.

PROFESSIONAL SITUATIONS WANTE—FEMALES.

ABLE visiting teacher has vacancies, prima academic English subjects, algebra, Latin, th ough French (Paris), German, advanced musi backward pupils, neglected education, polite co respondence, latest methods. Competent, 2 Herald.

A young lady, educated, refined, possessing e ecutive ability, able to assume responsibilit an excellent secretary, expert at clerical wor desires position part of day. Address Ability, 5 Herald.

A.—Italian young gentlewoman teaches Italia children also; highest references. Teacher, 3,1 Broadway.

Situations Wanted—15c. for first 2 aga lines; 5c. each additional line Daily; 16 line Sunday.

norrow.

Puzzles the Coroner.

t appears peculiar," said the Coroner ight, "that the woman should not have ght herself in such a narrow shaft had fallen, and also it is remarkable that ough she dropped eight or nine feet to surface of the water she was not cut or ised in any way. Then, of course, the t inexplicable fact of the whole affair is closing of the well trap."

he Coroner said he would hold an inst within a few days, and meanwhile tain Munro and several detectives will tinue their investigation. Although . Fox had lived on her farm for nearly uarter of a century, save for her boarder there were few in the community who w her.

lern knew more of her affairs than one else. He keeps a kind of small d-house at the farm and helps generally und the place. He said to-night that knew of no reason why she should have mitted suicide or why any one should e attacked Mrs. Fox. He believes that went to draw water, slipped and fell the well, but cannot explain the closof the trap, which, he asserted, was t when he went to the well this morn.

he police will search the bed of the l to-day to ascertain if the woman had ered a bucket before she fell to her th. None was found by the side of the l.

oroner Iles took possession of all the ers found in the woman's apartments. se included fire insurance policies, but e which would indicate that her life l been insured. There was some money l bank books, but no will. The well p was closed and sealed by the police night, and Captain Munro said he exted to establish before to-morrow night ether the woman's death was the result an accident or she had met with foul y.

CARED BY SUN DOG, HANGS HIMSELF

enomenon of Unusual Size and Beauty Awes Superstitious and Timid in Connecticut.

[SPECIAL DESPATCH TO THE HERALD.]

HARTFORD, Conn., Friday.—Throughout rthern Connecticut for several hours s afternoon a wonderful sun dog, of unual size and remarkable beauty, was ible. The strange phenomenon had a gular effect on the superstitious, who re expecting something dreadful to hapn on Friday, the 13th.

William J. O'Farrell, of No. 331 Front eet, who has been acting strangely ce he suffered an injury to his head o months ago, talked continually about day and the date to his friends and sured them that it was going to be a e day. When he saw the sun dog he ed out that the end was near and, going his attic, hanged himself.

V. W. Niefert, local weather observer, plained that the sun dog was due to st in the air and presaged a snowrm. A heavy fall of snow began about e o'clock to-night.

I am freed I do not intend to marry again."

Still, Mrs. Stonebreaker says she has known "Big Bill" Edwards a long time. "At one time people said we were engaged," she said. "But a girl usually is engaged two or three times before she actually is married, so that doesn't count."

Mr. Stonebreaker appeared in the office of his counsel soon after Mrs. Stonebreaker had left, and when told his wife had been in the place appeared to be surprised.

"There will be no reconciliation," he said.

A subpoena was served on Lester W. Orr yesterday. He lives in West Forty-fourth street.

MERRIAM DIVORCE CASE UP.

Wife, Suing Officer, Alleges He Has Failed in Monthly Maintenance Payments.

[SPECIAL DESPATCH TO THE HERALD.]

SAN FRANCISCO, Cal., Friday.—The Merriam divorce case, which a few months ago startled army circles, came up again to-day when attorneys for Mrs. Bessie C. Merriam appeared before Judge Graham in an attempt to compel Captain Henry C. Merriam to pay $75 a month separate maintenance, including the care of their little daughter, Charlotte.

The case went over a week when Attorney W. H. Linforth, for Captain Merriam, showed that $75 was sent to Mrs. Merriam the day before notice of to-day's action was given. The case, in which Captain Merriam named Colonel Clarence W. Murphy, who came from New Orleans to testify for the wife, has not been decided.

Mrs. Merriam to-day asked the Court to compel payment or adjudge Captain Merriam in contempt. She alleges he paid $35 and $45 and since then has been giving her only $5 a week.

DIVORCE FOR LUIGI MASNADA.

Justice Mills Grants Interlocutory Decree, Man Named as Corespondent Testifying for Husband.

[SPECIAL DESPATCH TO THE HERALD.]

WHITE PLAINS, N. Y., Friday.—Justice Mills to-day granted an interlocutory decree of divorce to Luigi Masnada, of No. 17 Prospect street, New Rochelle, and against Sara Lathrop Herreshoff Masnada, a daughter of Mr. and Mrs. J. B. Francis Herreshoff and a niece of Captain "Nat" Herreshoff, yacht builder. Mrs. Masnada lives at No. 54 West Ninety-second street, New York.

Giovanni B. Miozzi, a silk importer, who lives at No. 3 West 108th street, New York city, was named as corespondent, and was a witness for the husband. Mrs. Masnada did not defend the action.

Mr. Miozzi swore that, under the names of Mr. and Mrs. Manio Martini, he and Mrs. Masnada went abroad on board the Provence, of the French line, last July and remained at the Continental Hotel, Paris, until they returned on board the Majestic, of the White Star line, in October. Mr. Masnada formerly was a jockey at Belmont Park, but recently a silk importer.

few months lat to New York forbids either t months.

Stock No. 15.

White Fir.

HORNTON
AGER OF
RAILWAY

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London.

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EXECUTIVE

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Policies of Trans-
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[THE HERALD VIA COM-
MPANY'S SYSTEM.]

ERALD BUREAU,
130 FLEET STREET,
ndon, Saturday.

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Eastern Railway has
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away with the British
which I consider ad-

Nine Americans at Court with Mr. and Mrs. Pa

First Presentation of the Season Is Held at Buckingham Pa and Is a Very Brilliant Event—Queen Mary Ablaze with Gems, Including the Star of Africa.

Stock No. 15.

THE NEW SHOWER EMBROIDERIES ARE S

White Fir.

[SPECIAL DESPATCH TO THE HERALD VIA COMMERCIAL CABLE COMPANY'S SYSTEM.]

HERALD BUREAU,
No. 130 FLEET STREET,
London, Saturday.

The first court of the season was held by the King and Queen at Buckingham Palace last night. It was a brilliant affair, many strikingly beautiful costumes being worn, while the dazzling display of jewels made the scene one of exceptional brilliancy and splendor. The dresses and trains were enriched with the latest shower embroideries, which had a lovely effect. More than eight hundred persons were present.

King George wore the uniform of the colonel in chief of the First Life Guards. The Queen's dress was of blue and silver brocade, with a train of Honiton lace, and lined with silver tissue and trimmed with sprays of silver roses. She wore the crown pearls and diamonds and the famous Star of Africa diamond blazed on her corsage. Her other ornaments were rows and ropes of pearls and the Order of the Garter.

Mr. Walter Hines Page, the American Ambassador, presented his son, Mr. Arthur Page, and Mr. Edward Bell, Second Secretary of the Embassy, while Mrs. Page presented her daughter, Miss Page; her daughter-in-law, Mrs. Arthur Page; Mrs. Bell, mother of Mr. Edward Bell; Miss Kate Fowler, of San Francisco; Miss Sylvia Fox, of Philadelphia; Miss Harriet McCook, of New York, and Miss Elizabeth Wells, of Boston.

JUDGE CRITICISES THE WAR OFFICE SYSTEM

Says England Puts at Its Head Persons Who Have Never Worn Any Uniform.

[SPECIAL DESPATCH TO THE HERALD VIA COMMERCIAL CABLE COMPANY'S SYSTEM.]

HERALD BUREAU,
No. 130 FLEET STREET,
London, Saturday.

At the resumed hearing of the army libel action yesterday Justice Darling ex-

which she is a successful exhibi Basset hounds, this afternoon, wh the champions were paraded befo She also saw the dogs that receiv tinction for various acts of heroisr

MR. BELL'S WEDDING TO BE A QUIET

Second Secretary of American bassy in London Will Marry Surtees Next Week.

[SPECIAL DESPATCH TO THE HERALD V MERCIAL CABLE COMPANY'S SYST

HERALD BUREA
No. 130 FLEET STI
London, Saturd

In consequence of a recent bere and serious illness in the bride's the marriage between Mr. Edwa Second Secretary of the Americ bassy, and Miss Etelka Surtees w place quietly next week in Londo the Ambassador and Mrs. Page, t of the embassy and a few near have been invited.

MRS. LOTT DIES IN LONDON, AGE

Widow of Charles F. Lott, Francisco, Succumbs Af Long Life.

[SPECIAL DESPATCH TO THE HERALD MERCIAL CABLE COMPANY'S SYS

HERALD BUREA
No. 130 FLEET S
London, Satur

The death took place on Thursd 37 Matheson road, West Kensi Mrs. Jessie S. Lott, widow of C Lott, of San Francisco, in th ninth year of her life.

PERU'S VICE PRESI IS LEAVING FOR I

[SPECIAL DESPATCH TO THE HERALI MERCIAL CABLE COMPANY'S SY

HERALD BUR

'lane May n the Water

FROM THE SKETCH

E.R.N.

Planes That Can Be Un- ng Craft To Be oat.

the control is perfectly instinc- wheel being pushed forward and control the elevation of the ma- nd turned from side to side to t laterally. In turning the wheel e to side the rudder handle is ith the wheel, thus giving a per- al balance, and in turns it is only to off-set the rudder handle to or the other, still controlling the sition of the machine by turning and handle together sideways.

pe of control was adopted after udy had been made of all existing nd combines many features that ome standard in Europe, the r lateral balance by the steering r example, being the standard nt in the German army and he German Wright aeroplanes. l feature of the control is the nner in which the rudder control ed with the warping.

een known for some time that ht Company contemplated a control, and aviators have been rested to know what form this e. Expert flyers, among them Atwood, Oscar Brindley, Beck- ns and several of the army and en, have expressed admiration w system, particularly because inctiveness, which is bound to uch easier and safer to fly than

PLAY SEMI-FINAL ON TUXEDO COURTS

C. G. Osborne, of Chicago, and C. C. Pell Win Right to Meet for Gold Racquet Championship.

[SPECIAL DESPATCH TO THE HERALD.]

TUXEDO PARK, N. Y., Friday.—The semi-finals for the gold racquet championship were played on the courts of the Tuxedo Tennis and Racquet Club to-day. C. G. Osborne, of the University Club, of Chicago, defeated G. Maurice Heckscher, of the New York Tennis and Racquet Club, three games to two, and Clarence C. Pell, of the Tuxedo Tennis and Racquet Club, won from Arnold F. McCormick, of the University Club, of Chicago, three games to one. Messrs. Pell and Osborne will meet to-morrow in the final.

Mr. Osborne took the first game easily from Mr. Heckscher by 15—6, but the second was close all the way. The score was tied at thirteen all, Mr. Osborne finally winning by 18—15. The third game was also close, twelve all being called before Mr. Heckscher obtained a lead that brought him victory by 15—12.

The fourth game was all Mr. Osborne's, but the fifth and deciding one was a hard contest. Mr. Osborne in his first five hands scored fifteen aces to Mr. Heckscher's five. Mr. Heckscher, in his two hands that followed, added five more, bringing his score to 10—13. The Westerner, however, easily acquired by his effective service the two necessary aces for a 15—10 triumph.

Clever playing was witnessed in the match between Messrs. Pell and McCormick. Mr. Pell, the younger man, finally won through superior staying powers and effective returns of the long rallies.

The summary:—

Osborne vs. Heckscher.

FIRST GAME.

Osborne	6	8	1—15
Heckscher	4	1	1— 6

SECOND GAME.

Osborne			0	7	0	0	0	5	0	1	0	5—18
Heckscher	0	2	0	2	1	1	3	0	1	1	2	2—15

THIRD GAME.

Osborne	2	0	0	5	0	2	3	0—12
Heckscher	0	6	1	0	2	4	1	1—15

FOURTH GAME.

Osborne	1	2	0	1	0	0	0	1	0— 5
Heckscher	1	3	1	0	0	1	6	2	1—15

FIFTH GAME.

Osborne	1	3	1	0	8	0	0	2—15
Heckscher	0	0	0	1	4	4	1	0—10

Aces by services—Osborne, 37; Heckscher, 35. Aces by placing—Osborne, 20; Heckscher, 22. Aces

NO NEW TENNI

National Organi Discussion, M Policy at A

Arguments over definition of an ar took up most of th meeting of the Un Lawn Tennis Associ Waldorf-Astoria Ho ing of that body. T opposition develope offered by the orga Merrihew had draft

A vote of those pr was taken and the amendment was pas it one of the laws was necessary to hav

When it came to gramme there was cussion and delay th night before the res It seemed hardly pos be a chance of any ot the American body pat policy on the re trol the sport in thi

The change in the amateur definition fa being 87 in favor and

The amendment as hew was the followin

Has not accepted m game in a tourname tition, but a player, club or association tournament, match or it and sanctioned by National Lawn Tenn accept actual railroa his home to the city w is held, and such hos may provide, but sh money in lieu of hospi

A player when of represent an associa world's championship petition or in a tourna auspices of the U. S. representative team c ceive from such asso necessary travelling a ing expenses. Such must report the tota such player on reques Committee of the U. S. or association must of the holding of a to the secretary of the U. amounts paid by them portation and expense participated in such to names of such players.

Robert D. Wren

Outside of the choice dent and the secretary cers was cut and dried. was again elected to t Henry W. Slocum, the

Stock No. 16.

Engelmann Spruce --- Colorado.

Stock No. 16.

Engelmann Spruce — Colorado.

...NTS TO LET—
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... to North River

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... Facing Columbia
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...partments
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...8th St.

...DE DRIVE.
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...OOMS,
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...3,000.
...MISES.

...IFUL APART-
...ARGE ROOMS,
...L NIGHT ELE-
...ERY MODERN
...ERAL CONCES-
...IFTH FLOOR,
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... 93d st.—Fireproof
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...2 Pine st. 'Phone,

...GTON,
...tral Park West;
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... three baths. Resi-
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... Above 125th st,
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...BATHS
...E AND LARGE.
...stor house,
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...IGHBORHOOD.
...e of closet room,
... night service.
...3 B'way (147th st.)

...D BATH.
...d 175th st.
...l 175th st.
...outside rooms.
... 3,573 Broadway.

...ENTS WANTED.

...modern, kitchenette
...erage; state terms,
...S., 186 Herald.

...0c. agate line Sun...
...Ask about weekly

...SORTS.

...nd.

...ls Inn
...S from Penna. Station.
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LENOX AV., 249.—Comfortable furnished, ... Room; two gentlemen or couple; excellent ta... Jewish.

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36TH, 62 West.—Rooms, large, small; run... water; home cooking; telephone; moderate; ... erences exchanged.

49TH, 68 West.—Established 25 years; Ro... Suites, baths, telephones; superior table.

54TH ST., 15 East.—Two houses in one; ... celled table and residentially; moderate ... references.

54TH ST., 54 WEST.
SINGLE AND DOUBLE ROOMS; REFEREN...

57TH, 359 West.—French Board, large and s... rooms, French cooking; telephone.

68TH, 67 WEST.—LARGE, SMA... ROOMS; HOT, COLD WATER.

71ST, 135 West.—Exceptional Board; ... double Room; private bath, lavatory, s... heat, electricity.

72D, 122 WEST.
Desirable Suites of one and two rooms; ... class accommodations.

72D ST., 118 West.—Handsome second ... front, private bath; also Room adjoining...

72D ST., 263 West.—Large, small Rooms; pr... bath; every comfort; reasonable rates; cuisi...

75TH ST., 155 West.—Richly furnished hom... refined people desiring comforts, social... roundings; exceptional Hungarian table; si... double Rooms with bath.

75TH, 18 West.—Double and single Rooms, ... furnished; homelike; German cooking; ... guests.

79TH, 114, 132 WEST
Unusual and attractive "Pensions," with ... parlors, tea room and lounge; Southern coo... white maid service; steam heat and telepho... every room; references; booklet on request.

79TH, 162 West.—Handsomely furnished ... Room; first class boarding house; refer... Schuyler—5475.

80TH, 123 West.—Small, medium Rooms, furnished; homelike; congenial; excellent ... sine; moderate; references.

82D, 54 W.—Large single Room; sunny; ... excellent table; parlor ... room; references.

83D, 5 West.—Suites, singly; steam, electri... continuous hot water; excellent meals; ... guests.

85TH, 333 West.—Large front Room, suitabl... two; all conveniences; private family.

86TH, 23 West.—Attractive, sunny, m... Room, Board; table guests accommodated; ... class house.

93D, 128-130 West.—High class boarding h... table guests accommodated; parlor dini...

94TH, 73-75 West.—Large and small, ... Rooms; Board optional; references; Chris...

95TH, 65 West (Rozelle).—Handsome Rooms ... cellent meals; Southern cuisine; exceptiona... vice; reasonable prices.

96TH, 14 West.—Beautiful, large, warm Ro... park view; subway; superior table Board; ... erence.

102D, 253 West (La Grange-Trouville).—Acco... dations unsurpassed; Suite, private bath (... two), $25; single Rooms, $10; Electric Li... Superior Cuisine; Telephone.

105TH, 76 West.—Good Rooms, good table, h... like atmosphere; 30 of our guests with us ... one to six years; vacancies because we tak... ...reasonable.

105TH, 309 West.—Beautifully equipped, new ... vate Dwelling, overlooking Hudson; clean ... airy; all rooms have running water; six bea... bathrooms.

126TH, 122 West.—Beautiful warm Rooms ... perior house; attractive table; moderate te... subway, "L."

126TH, 122 West.—Beautiful warm Rooms ... perior house; attractive table; moderate te... subway, "L."

150TH, 525 West.—Front Room, southern e... ure; nicely furnished; private family; r... ence; steam, 'phone.

Boarders Wanted—20c. agate line D... and Sunday. Ask about weekly ... rate.

COUNTRY BOARD.

New Jersey.

LENOX MANOR 75 Lenox ... East Orange, ...

hoked on Honeymoon by ged Mate Says Young Bride

. Matthew Donovan Files Cross Bill to Wealthy Husband's Action for Divorce—Were Married in St. Patrick's Cathedral, New York.

LLS OF TEARING UP NEW PARIS HAT

PECIAL DESPATCH TO THE HERALD.]
NTON, N. J., Friday.—Accusing her nd, sixty-one years old, of having n and choked her, whenever she spoke ny one during their honeymoon in pe a year ago, Mrs. Matthew Donovan, y-one years old, to-day filed a cross his action for divorce. Mr. Donovan, is a furniture dealer in Paterson, is reputed to be worth $500,000, with nual income of $25,000.

couple were married in St. Patrick's edral, New York city, on January 21, and a month later started on their moon in Europe. According to the bill filed by Mrs. Donovan the life of ouple, almost from the moment of marriage until their separation last mber, was a series of slapping and ng exhibitions, in which she was the 1.

ying any wrongdoing, Mrs. Donovan es her husband of being insanely is and declares that he slapped and d her whenever she attempted to to acquaintances they made during tour. In Seville, Spain, she says, Donovan beat her with his fists and went before the American Consul and lodged a serious charge against The Consul, she says, ordered her to accompany her husband back to America.

Later, while on a train for Madrid Mrs. Donovan says that she and her husband quarrelled. In a rage, she declares, he seized her by the throat, pushed her head back against the edge of the seat and ordered her never to speak to him again.

In Paris the youthful wife declares that she purchased a hat just preceding one of the regular quarrels. Her husband, she says, grabbed the hat from her hands, tore it up and trampled on it. On the way home, she says, Mr. Donovan locked her in her stateroom because she dined with another passenger after she had first obtained her husband's consent.

There was less peace in the household in Paterson than there was on the honeymoon, Mrs. Donovan says. On July 14 the husband is accused of having attacked a Paterson physician, in front of the City Hall at Newark whom he found with his wife in an automobile. Later in the day he saw his wife in the automobile and it became stalled. She says that she jumped from the seat, ran until she was exhausted and was then picked up and taken home by her husband.

Mrs. Donovan left her husband three times during last summer, each time returning. Finally in November she left him for good, declaring that she was unable to stand his brutality. Other acts of cruelty are charged against Mr. Donovan, some of them of a sensational nature.

G BILL' ONLY CHUM, SHE SAYS

ke to Mention One-Time City ficial in Divorce Proceedings, Mrs. Stonebreaker Declares.

Bill" Edwards was warmly de- l yesterday by Mrs. Constance oreaker, whose husband, Joseph R. oreaker, is suing for divorce and g several prominent persons as be- nnected with the case. It was said were so many persons prominently ted that it would be dropped before

HIS WIFE HERE IS DIVORCED IN WEST

Mrs. Vivian Raymond Jackson's Politician-Husband Gets a Quick Decree in Tacoma, Wash.

[SPECIAL DESPATCH TO THE HERALD.]

TACOMA, Wash., Friday.—Clark R. Jackson, chairman of the State Tax Commission, obtained a quick divorce this week from Vivian Raymond Jackson, of No. 225 West Sixty-ninth street, New York. They were married July 31 last at Spokane. Mrs. Jackson is permitted to resume her

ADMITS BUT

John Anderson Says Affair a F

That he may ha bit is not denied b wife, Margaret, da iam H. Ebling, f seeking a divorce, Lorraine Parker, further he denies two hours on the day afternoon, w cross-examination counsel for Mrs.

Mr. Bamberger written by Mr. A and attempted to emotions when h penned endearing Anderson was co ways wrote "in sometimes did not to just what he v

Two detectives v by counsel for M fied to going to Millie Wilson, a fr where they were the witnesses sa Miss Parker, the in a kimono, and went directly to mained from abou evening of Septer half-past ten o'cl

Solomon Braker, called into the ba Miss Parker's roo hole in the top Parker's room, he derson and Miss P fully clad. The ap looked, the detect the door warping. opening was very mitted that it was that he did not ta ceal himself.

Counsel for Mr. that his client wa of Miss Parker. w him, and for that was placed on t through which the The case will be

GOLF A SEP

Mrs. Wootan Al ished After Was Trea

Mrs. Bertha Vi

Stock No. 17.

Amabilis Fir.

pelts and patch pockets, nearly all with two pa...
all styles.

leading makers in Amei...
in medium and heavy...
fitting models, some w...
as $14.50.

6.50 to $10 Suits & Overcoats, $4.50

a wonderful opportunity for those who desire a
...ge of boys' clothing; sizes 2½ to 18. Many a prize
...t.

Men's $18 to ...

Many Overcoats fu...
fabrics. The Suits in t...
mixtures; all sizes, 33...
garments.

2 to $3 1914 ... Suits, $1.10
... styles, for boys 2½

Boys' 75c Separate Trousers, 35c
Gray and blue mixtures; sizes 6 to 17.

Stock No. 17.

Men's $15 ...
Chauffeur...
Men's $10 and...
Men's $4.5...
Men's $8.5...
Men's $15 M...
Men's $3 ...

...hs' $12 and $15 Suits and Overcoats, $6.50

Amabilis Fir,

... one all wool, good standard quality; styles and
... young men; sizes 32 to 42.

BLUM BROTHERS' SPECIALIZ...

...men's Suits
...sts and Blouses
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And there will be wonderful Bargains i... following Sections TODA...

...'s Suits
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... and Waists
... Underwear
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...n's Shoes
...rs
... Jewelry
... Silverware
...ilverware
... Articles

Carpets and Linoleums
White Goods
Children's Dresses
Children's Wraps
Buttons and Braids
Art Needlework
Women's Neckwear
Leather Goods
Traveling Bags
Ribbons
Laces
Handkerchiefs
Embroideries
Infants' Outfits

Colored Petticoats
House Dresses, Ne...
Corsets
Trimmed Milliner...
Kid Gloves, Fabric...
Colored Dress Goo...
Flannels

Men's an...

Furnishings
Gloves
Hosiery

Raincoat...
Leather ...
Shoes—...
Boys' Ha...

...o small measure the glorious ...e of George Borrow." Mr. ...ls, with an amount of detail ...t seem superfluous in the case ...f less individuality, with Bor... ...n, birth and upbringing dur... ...roublous times when Napoleon ...ding menace to England, and ...is many journeys to far off ...which he obtained material ...ks. He gives us, moreover, a ...Norwich of his day and of the ...and women of literary taste ...ment whose influence remained ...hroughout his life. He tells us ...aordinary facility in the ac... ...f foreign tongues, of his in... ...e of prize fighting—his own ...t "Big Ben," a famous pugil... ...ay, in Hyde Park—and of his ...ess for the wandering gypsy ...read of his journey to St. ...n the interest of the Bible So... ...s various trips to Spain, and ...d helps us to a better under... ...his work. There are still many ...try who read "Lavengro" and ...in Spain," and to these Mr. ...lume will prove of value and ...it can awaken a new interest ...e subject the author will have ...till greater service to our gen...

...'s "Joan's Green Year" (Mac... ...love story, charmingly writ... ...of gentle feminine sentiment ...ve a strong appeal for those ...preciate a quiet story of Eng... ...e. It takes the form of a se... ...rs written by Joan Cantley ...ded house to her brother in ...ts pages are rich in descrip... ...stic life and a sympathetic ...the little comedies and trag... ...ake up neighborhood interest. ...er of these events presents ...as a woman of good social ...ondon who has written books ...to marry a lord, not because ...ke in the offing, but because ...love him. This may seem ...any of those who have been ...modern British fiction, but a ...event awaits those who fol... ...career to the end. For the ...English fiction, so far as my ...s, an attractive heroine is ...er publisher. In real life, of ...shers woo and win and are ...ooed almost every day in the ...nen with manuscripts to dis... ...in this novel we see a pub... ...a much sought after bride ...For my own part, I am glad ...e done to a well deserving ...ithout publishers there would ...l for manuscripts, and even ...always eager to accept them. ...n rambling from my subject. ...is made up of a number of ...She describes the family at ...rm, which receives her as a ...as the English politely term ...guest." She tells the pathetic ...Ingleby, whose farm, held by ...forebears for two centuries, ...him and is cut up into small... ...And she relates also the still ...episode by which he loses the ...loves. Another tragedy is ...ret Derston, the victim of a ...band, and there are brighter ...tell of troubles cheerfully ...affairs with a satisfactory ...he whole, the book has a ...nosphere that cannot fail to

---

...time since I have read any...

...her level in a duel. On the death of this brother, some forty years later, she had a square of glass let into the floor of the family pew which was directly over the family vault. In her brother's coffin she had glass placed directly over the face and, the coffin being put in place, she gazed once, but once only, upon the man who had ruined her life. Then there were less tragic figures, such as Mrs. Thorn, once a handsome fish girl, whose marriage proved exceedingly happy in spite of much opposition, and Mrs. Blackford, wife of the doctor, who considered herself scientific by marriage and had learned to know what she was supposed to see down her husband's microscope. The book is delightfully written with a distinction and simplicity of style as charming as it is unusual.

When Bret Harte opened for us the door into that magical though unreal world of California in the days of the gold seekers he also cleared the way for a host of imitators. It is impossible to read "The Twins of Suffering Creek," by Ridgwell Cullum (Jacobs), without realizing that the author is an admirer of "The Luck of Roaring Camp" and "The Outcasts of Poker Flat." It is the story of a Western mining camp, of an inadequate, amiable man whose handsome wife runs away with the good looking desperado of the vicinity, leaving her twin children to the care of their hopelessly incompetent father. The situation appeals to the compassion of the camp, and a syndicate is formed for the care of the children under the leadership of one "Wild Bill," a gambler, horse lover and general master spirit of the camp. Of course this syndicate is entirely unable to cope with the situation, and its attempts afford an opportunity for what the author evidently considers humor, but which seemed to me but a dreary succession of foolish incidents. The forsaken husband is so anxious to have his wife back, so loyal to the mother of his children, that the heart of "Wild Bill" is touched and he goes forth to kill the man who has added to his other crimes that of stealing a man's wife. The gambler succeeds, losing his own life in the act, and the repentant Jessie returns to her husband, who has found an oil well on his claim instead of the gold for which he was looking, and whose twins are further provided for by inheriting "Wild Bill's" bank account, some seventy thousand dollars. The book is poor in character drawing, dull in incident and extremely tiresome to read.

Tolstoy's Short Stories, published at a cheap price as No. 129 of the Scott Library, are very much like the stories of Russian peasant life that so many authors have given us. I have never been strong for

...ing their functions ...strongly the latter ...British Parliament. ...considers that politi... ...means in Germany w... ...land he is much misl... ...its original theory of ...a numerical basis, the ...have about six hund... ...stead of 397, and the ...the towns should be ... ...What the author has ...the elaborate police sy... ...is interesting, though ...aghast at the idea of ...the population being ...of the intricate system ...vision Mr. Tower think... ...doubtful preventive o... ...tends that it is of littl... ...ing of criminals. Whe... ...chapter on municipali... ...housing conditions in ...stance, are far from ...the streets are beaut... ...the apartment houses ...boxes seem very att... ...rents are high, and ...wish something less ...obliged to go into ...rooms at the rear, look... ...yard which twice a we... ...beating of innumerable ...are other chapters, de... ...topics as education ca... ...and intellectual life, an... ...teresting as well as instr...

White Spruce.

Grinder Run No. 190.

Western Hemlock.

Grinder Run No. 9.

Sitka Spruce.

Grinder Run No. 6.

Lodgepole Pine. --- Montana..

Grinder Run No. 14.

Western Yellow Pine.

Grinder Run No. 8.

Balsam Fir.

Grinder Run No. 27.

Lodgepole Pine --- California.

Grinder Run No. 1.

Red Fir.

Grinder Run No. 2.

Hemlock.

Grinder Run No. 61.

Tamarack.

Grinder Run No. 27.

Noble Fir.

Grinder Run No. 11.

Alpine Fir.

Grinder Run No. 12.

White Fir.

Grinder Run No. 24.

Engelmann Spruce --- Colorado.

Grinder Run No. 14.

Amabilis Fir.

Grinder Run No. 10.

Jack Pine.

Grinder Run No. 30.

White Pine.

Grinder Run No. 11.

Aspen.

Grinder Run No. 3.

Birch.

Grinder Run No. 5.

Black Gum.

Grinder Run No. 10.

Loblolly Pine --- fall cut.

Grinder Run No. 19.

Loblolly Pine --- Spring Cut.

Grinder Run No. 18.

Lowland Fir.

Grinder Run No. 2.

Engelmann Spruce --- Montana.

Grinder Run No. 10.

Western Larch.

Grinder Run No. 1.